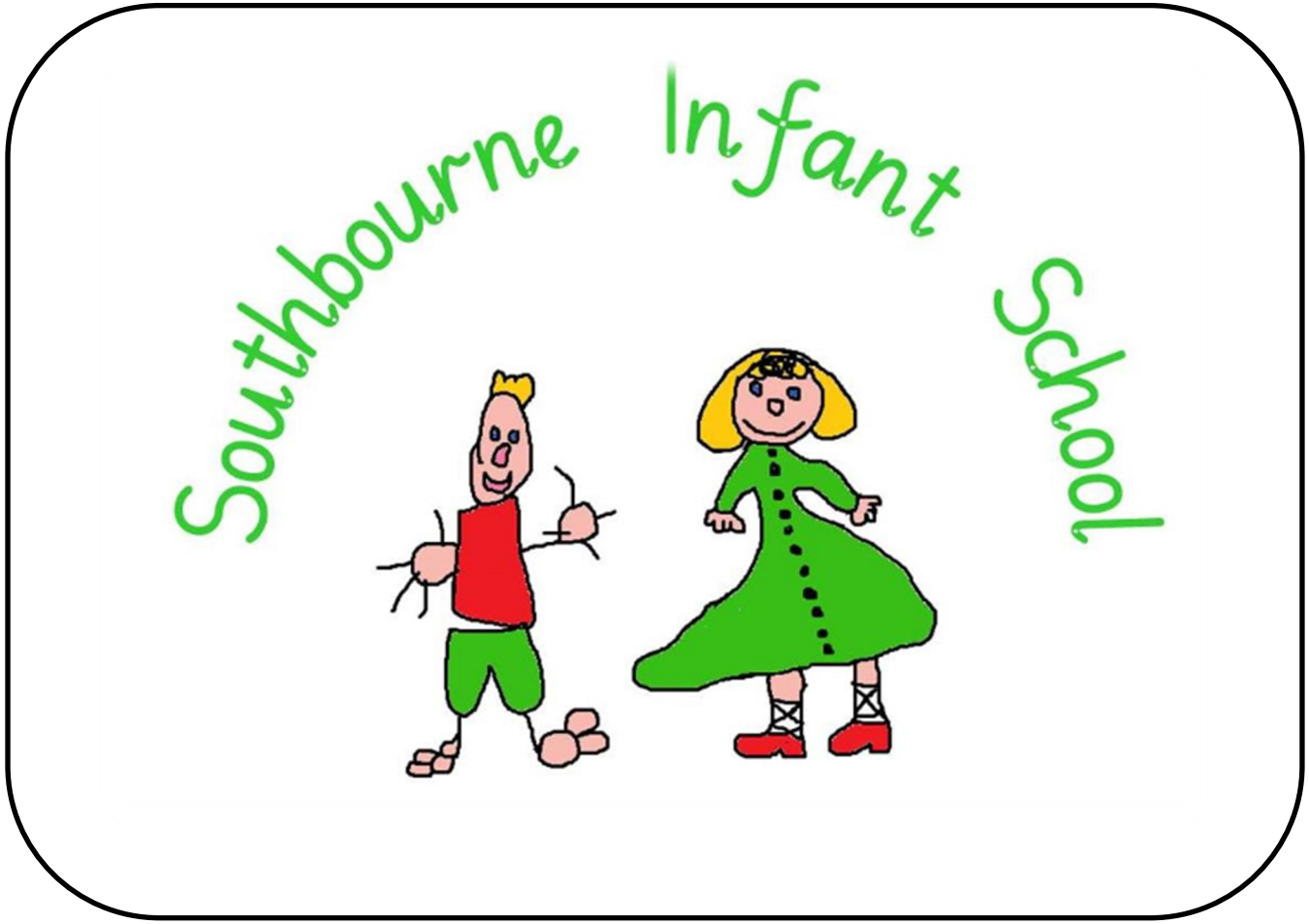
Calculation Policy

March 2023



Calculation Policy - Concrete, Pictorial and Abstract

Concrete, Pictorial, Abstract (CPA) is a highly effective approach to teaching, that develops a deep and sustainable understanding of maths in children.

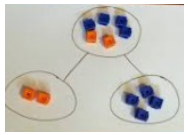
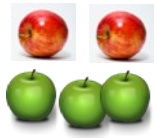
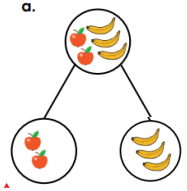
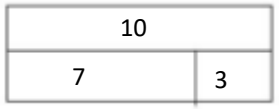
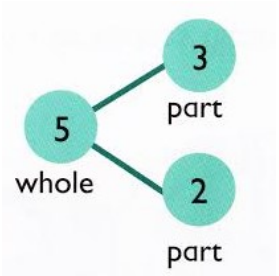
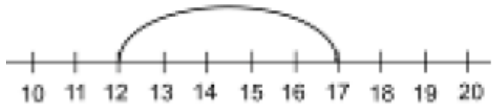
- **Concrete** is the 'doing' stage, using concrete objects to model problems.

- **Pictorial** is the 'seeing' stage, using representations of objects to model problems. This stage encourages children to make a mental connection between the physical object and abstract levels. This may include looking at pictures, drawing representations or diagrams.

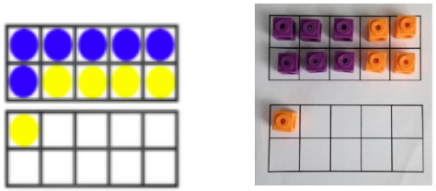
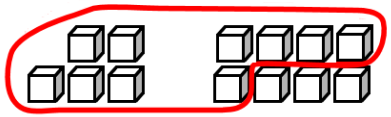
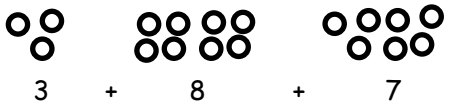
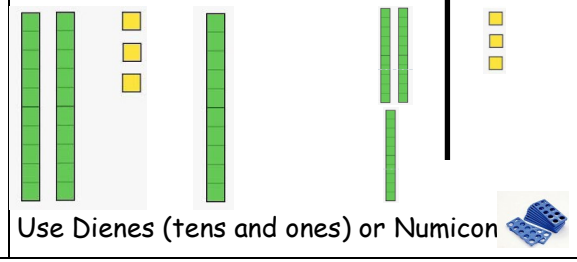
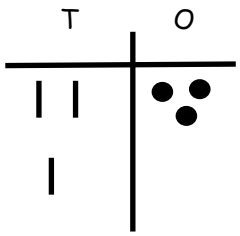
- **Abstract** is the 'symbolic' stage, where children are able to use abstract symbols to model problems. Children are introduced to mathematical symbols, for example +, -, x, ÷ to indicate addition, subtraction, multiplication and division.

Calculation Policy—Addition

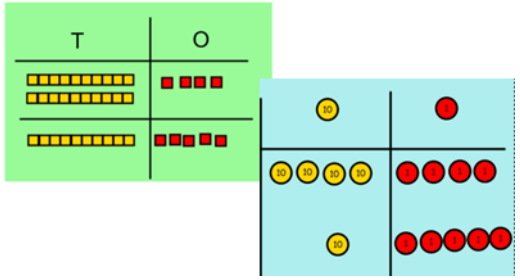
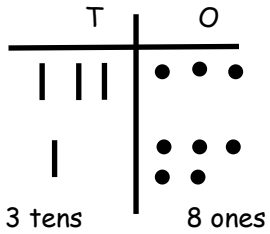
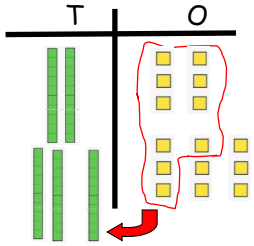
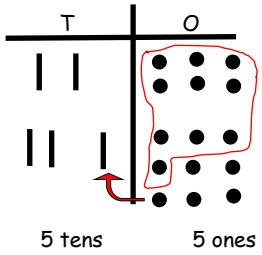
Key language: sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' 'is the same as', total, count on.

	Concrete	Pictorial	Abstract
Combining two parts to make a whole . Part Whole	  Use cubes (or other objects) to add two numbers together    	a.  Use pictures to add two numbers together in a group or in a bar.   10 7 3	Use a Part-Part Whole diagram to move into the abstract. 3 + 2 = 5 2 + 3 = 5 5 = 3 + 2 5 = 2 + 3  3 part 5 whole 2 part
Starting at the bigger number and counting on.	 12.....13, 14, 15, 16, 17. Start with the larger number and count on the small number. 4...5, 6. 	 10 11 12 13 14 15 16 17 18 19 20 I have 12 marbles. My friend gives me 5 more, how many marbles do I have? Start on 12 on a number line and count on 5 ones.  My 0 to 20 number line 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer. Remember the larger number may not always be the first number

Calculation Policy—Addition

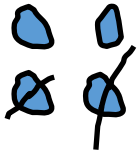
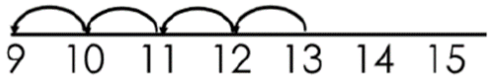
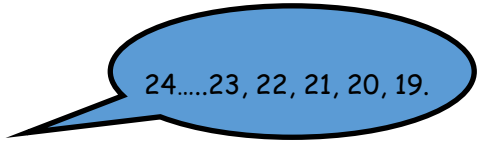
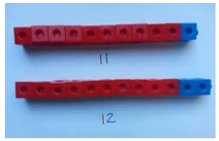
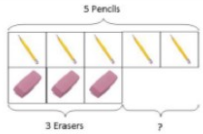
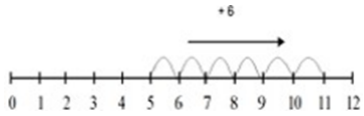
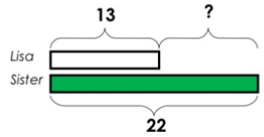
	Concrete	Pictorial	Abstract
Regrouping to make 10. *This is an essential skill for column addition later.*	Using a tens frame and counters/objects. Start with the bigger number and use the smaller number to make 10. 6 and 5 	 Use pictures or a number line. Regroup or partition the smaller number to make 10.	7 + 4 = 11 If I am at seven, how many more do I need to make 10? How many more do I add on now? 7 + 3 + 1 = 11
Adding thee single digit numbers.	 7 and 3 make 10. 10 and 8 make 18	 3 + 8 + 7  10 + 8 = 18 Draw a picture to recombine the groups to make 10.	Combine the two numbers that make 10 and then add on the rest. 6 + 5 + 4 = 6 + 4 = 10 10 + 5 = 15
Adding a 2 digit number and a ten or multiple of ten.	23 + 10 = 33  Use Dienes (tens and ones) or Numicon	 Children draw tens and ones grid and then draw sticks and dots to represent the tens and ones.	23 + 10 = 23 I know that 10 more than 23 is 33. Introduction of the column method. 2 3 + 1 0 3 3

Calculation Policy—Addition

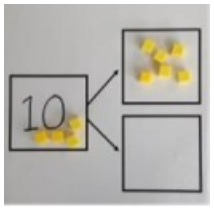
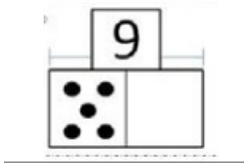
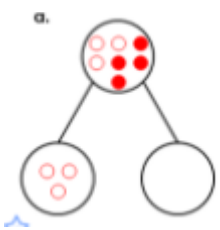
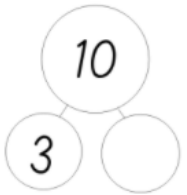
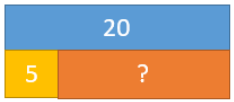
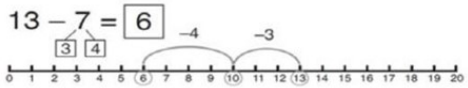
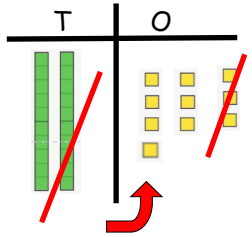
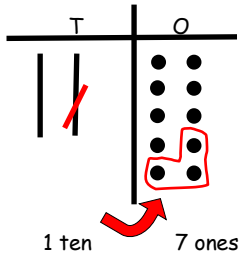
	Concrete	Pictorial	Abstract
Adding two digit numbers— no regrouping	Add together the ones first then add the tens. Use Dienes first before moving onto place value counters 24 + 15 = 38  	Draw tens and ones grid and then draw sticks and dots to represent the tens and ones. Add the ones and then the tens.  3 tens 8 ones 23 + 15 = 38	23 and 15 = 38 I know that 3 and 5 is 8, and 20 and 10 is 30. 30 + 8 = 38 2 3 + 1 5 3 8
Adding two digit numbers— with regrouping	Use ten Dienes, spotting the 'Sneaky ten'. Swap tens ones for a tens stick. 26 + 29 = 55  5 tens 5 ones	Draw a tens and ones grid, draw the sticks and dots to represent tens and ones. Spot the 'Sneaky Ten' and swap tens ones for a ten stick. 26 + 29 = 55  5 tens 5 ones	Column method. 2 6 + 2 9 5 5 1 Add the ones. One ten to carry over to the tens column. Add the tens, including the carry-over.

Calculation Policy—Subtraction

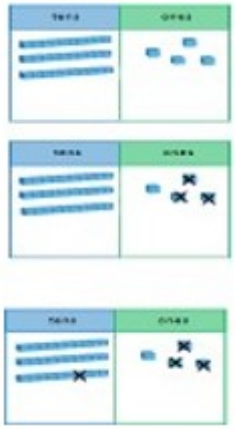
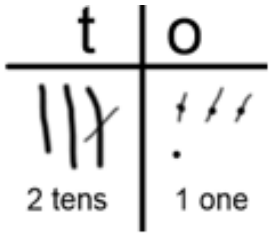
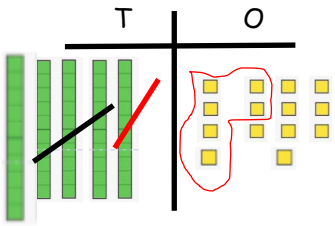
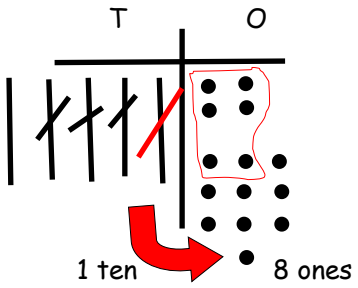
Key language: count back, parts and whole, take away, less, minus, subtract, difference between, fewer, least.

	Concrete	Pictorial	Abstract
Take away in ones.	Use physical objects, counters, cubes etc to show how objects can be taken away.  Four bears at the picnic. One goes home. How many are left?	Cross out pictures or drawn objects to take away. 4 take away 2 equals 2  	10— 3 = 7 15—2 = 13
Counting back	Children jump back on a number line/lily pads.  	Counting back on a number line in jumps of 1 	24 =- 5 = 19 Put 24 in your head and count back 5. 
Finding the difference	Compare objects and amounts   Lay objects to represent bar model.	Count on using a number line to find the difference.  **Comparison Bar Models** *Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.* 	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches. 23—15 = 8

Calculation Policy—Subtraction

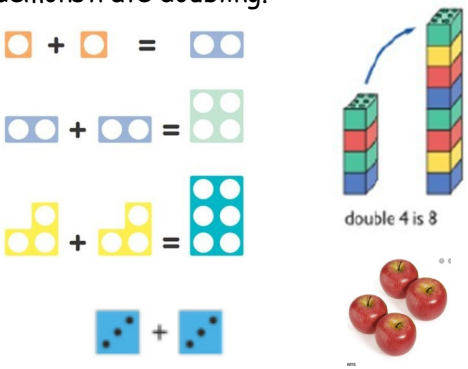
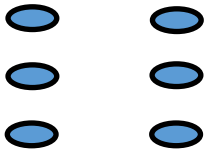
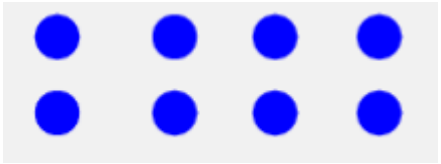
	Concrete	Pictorial	Abstract
Use the inverse relationship to solve missing number problems. Part-Part Whole	 If ten is the whole and 6 is one of the parts what is the other part?	 7—3 = 	 I have 10 buns. I sell 3 at a cake sale. How many buns are left? 
Make 10	 14-5=9 Make 14 on the ten frame or with different coloured cubes to represent the ten and the ones. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.	 Jump back 3 first, then another 4. Use ten as the stopping point.	15 – 7= How many do we subtract to reach the next 10? How many do we have left to subtract? 15 –5 –2 =8
Regrouping a ten into ten ones	20 - 3 = Use Dienes to exchange a ten for ten ones and then take away 3. 	20—3 = 17  Children draw tens and ones grid and then draw sticks and dots to represent the tens and ones.	20—3 = 17

Calculation Policy—Subtraction

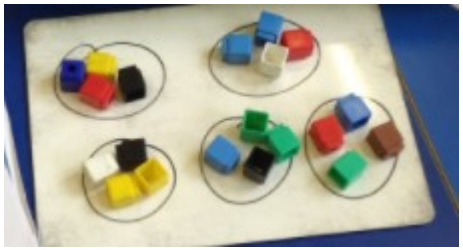
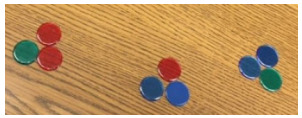
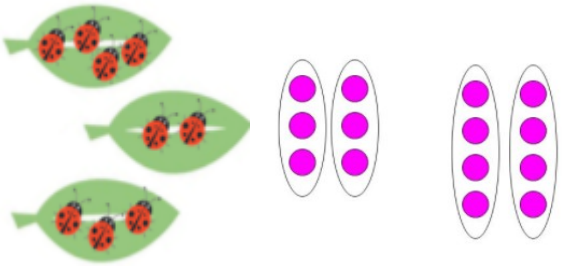
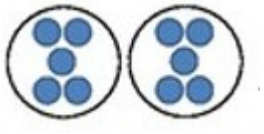
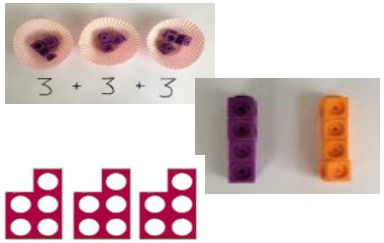
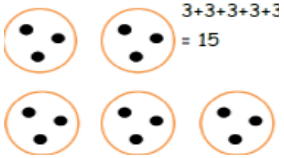
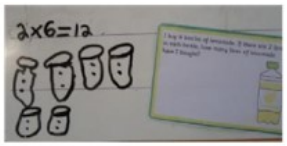
	Concrete	Pictorial	Abstract
Subtract two 2 digit numbers with no regrouping.	34—13 = 21 Use Dienes to show how to partition the number when subtracting without regrouping. 	Children draw representations of Dienes and cross off. 34 – 13 = 21 	34 – 13 = 21 30 – 10 =20 4 – 3 = 1 3 4 + 1 3 2 1
Subtract two 2 digit numbers with regrouping.	54—36 = 18  1 ten 8 ones Exchange a ten, take away 6 ones, then take away 3 tens.	54—36 = 18  Children draw 'sticks and dots' to represent 10s and ones. Cross off one ten and draw ten ones. Cross out 6 ones and then cross out 3 tens.	54—36 = 18 You cannot take 6 ones away from 4 ones so we need to borrow a ten. 14 ones —6 ones = 8 ones 4 tens—3 tens = 1 ten $^{4}\not{5}\ ^{1}4$ + 3 6 1 8

Calculation Policy—Multiplication

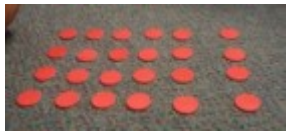
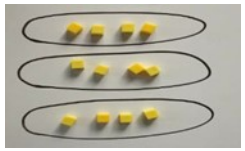
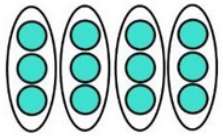
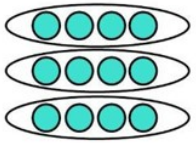
Key language: doubling, times, multiply, multiplied, repeated addition, lots of .

	Concrete	Pictorial	Abstract
Doubling	Use practical manipulatives including cubes, Numicon and real life objects to demonstrate doubling. 	Double 4 is 8  Drawing pictures to represent doubling 	3 + 3 = 6 4 = 4 = 8 Partitioning a number before doubling. Double 12 10 + 10 = 20 2 + 2 = 4 20 = 4 = 24
Counting in multiples of 2s, 5s, 10, and 3s. (skip counting)	Count the groups as children are skip counting, children may use their fingers as they are skip counting. 	Children draw representations to show counting in multiples. 	Count aloud in multiples. Write sequences with multiples of numbers including working out missing numbers in sequences. 2, 4, 6, 8, 10, 5, 10, 15, 20, 25, 30, 30, ___, 50, ___, 70.

Calculation Policy—Multiplication

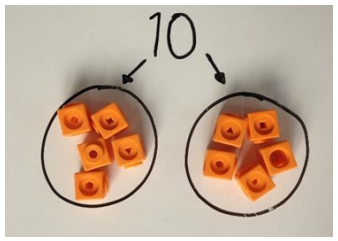
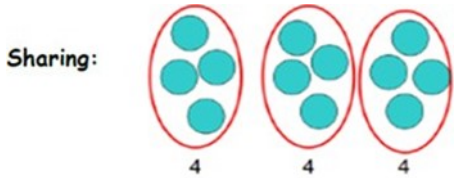
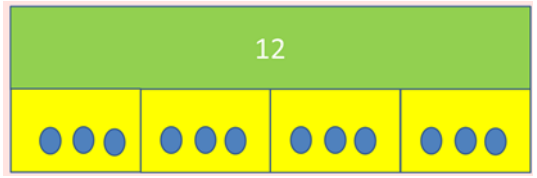
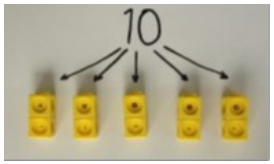
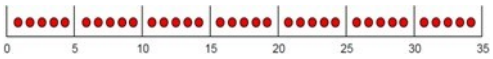
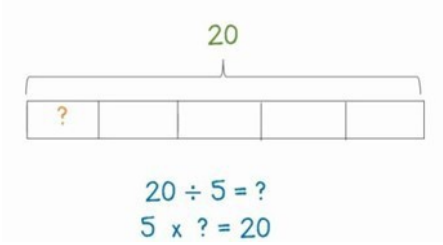
	Concrete	Pictorial	Abstract
Making/recognising an equal group	 Using manipulatives to make equal groups. 	Using pictures or drawings to recognise and make equal groups. 	 2 groups of 5 2 x 5 = 8
Repeated addition	Children use concrete objects to make repeated addition number sentences. Skip count to work out the answer.  5 10 15 5 + 5 + 5 = 15	There are 3 sweets in one bag. How many sweets would there be in 5 bags?   Children begin to recognise the relationship between repeated addition and multiplication.	 2 + 2 + 2 + 2 + 2 = 10 2 x 5 = 10 Write number sentences to describe pictures or objects.

Calculation Policy—Multiplication

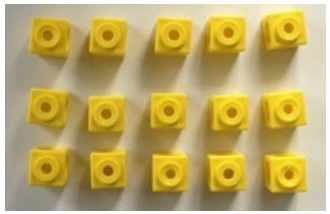
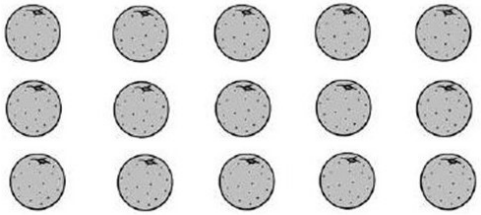
	Concrete	Pictorial	Abstract
Multiplication— using arrays to show that multiplication is commutative.	    Children use concrete objects to make arrays and spot them in everyday life.	Draw arrays in different rotations to show that multiplication is commutative .  4 groups of 3 4 x 3 = 12  3 groups of 4 3 x 4 = 12	Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15

Calculation Policy—Division

Key language: share, equally, groups of, divided by, division.

	Concrete	Pictorial	Abstract
Sharing	  10 cubes shared equally between 2 groups.	 12 shared between 3 is 4 Children use pictures or shapes to share quantities into groups or using a bar model. 	$20 \div 5 = 4$ Use recall of division facts or the inverse of multiplication facts $5 \times 4 = 20$ So $20 \div 5 = 4$
Division as grouping	Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.  	Use a bar model to split the number into groups and share equally. 	$25 \div 5 = 5$ Divide 25 into 5 groups. How many are in each group? Count in 5s until you reach 25. How many 5s are in 25?

Calculation Policy—Division

	Concrete	Pictorial	Abstract
Division with arrays	 Link division to multiplication by creating an array and thinking about the number sentences that can be created. 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	Draw an array and use lines to split the array into groups to make multiplication and division sentences.  15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	Find the inverse of multiplication and division sentences by creating eight linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7 28 = 7 x 4 28 = 4 x 7 4 = 28 ÷ 7 7 = 28 ÷ 4