Calculations Policy

Policy Owner	Mr J Darby
Date Approved	5th February 2024
Governor Name	Mr S Hill
Governor Role	Chair

Admin use only	
Location	
Website	
Learning Platform	
Policies File	
Staff room	
Headteacher's File	
Policies Log updated	

Guidance

Place value language: HTU, or HTO?

We will use the word '*units*' and the symbol, 'U' to avoid confusion with the number '0', however, the children will come into contact with the language '*Ones*' and so **these two terms will need to be used interchangeably** when talking about the '*Ones/units number*', or '*Ones/units digit*'.

Place value: to use ',' or not to use ','?

For larger numbers **we will use numbers with and without commas interchangeably**, e.g. 1,000 will be written as 1000. This is because the comma is used sometimes as a decimal point when working in Euros and also in separating numbers written in a sequence. **It is expected** that the children will have the opportunity to read and write numbers using the comma and be taught of its significance in denoting thousands, then millions.

Equal (=) opportunities: what do we call it and when?

From foundation to year 6 the word, '*equals*' will be used and we will say it means, '*the same as…*' e.g. 10 = 3 + 7 will be read as, '*ten equals three add seven*,' which means, '*ten is the same as three add seven*'; it will then be explained that, '*this means what's on this side [10] is the same value as what's on this side, [3 + 7]: looks different, but means the same.*'
Children will also from year 1 onwards come into contact with balanced equations, or simply two number sentences that are equal, in order to reinforce the concept of 'equals' e.g. 3 + 7 = 6 + 4. Opportunities like this should not be missed, for example when reinforcing number bonds e.g. 10 + 0 = 7 + 3 = 6 + 4, or missing number calculations as an *App/Challenge* e.g. 20 + 4 = 19 + __?

AREs: outwards, not upwards.

As much as possible, and in order to ensure that children are given the opportunity to become 'masters' at a particular stage in their mathematics, children should be kept within their AREs. That means teaching to ensure some children keep up and that others are *challenged* in their thinking. **Resist the temptation** to give children greater numbers with which to calculate: children's learning should be deepened and not just accelerated – use *Apps/Challenges* in order to support this, such as missing number sentences, problem solving – worded and/or visual.

'Keep up!' How do we make sure we can stay together?

If a child is struggling, go back and **use a concrete resource** to reinforce a concept; use smaller numbers, or break down the learning into smaller steps. Let the children do the working physically in order to secure a new concept: **pre-teaching will be used** during booster groups to ensure all children have the best chance of moving forward in their learning and boosters will pick up the learning using concrete apparatus with smaller numbers and/or the stage before if a concept is still not understood.

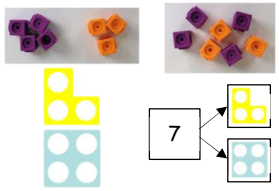
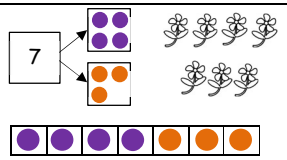
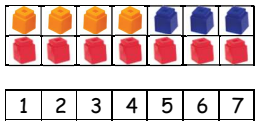
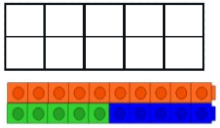
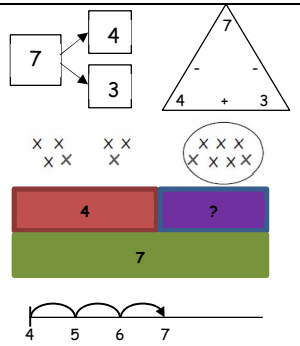
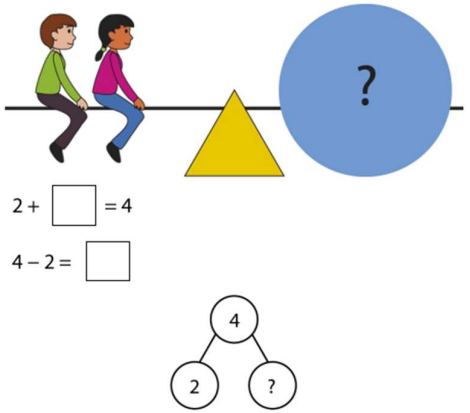
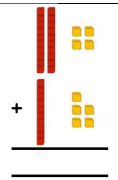
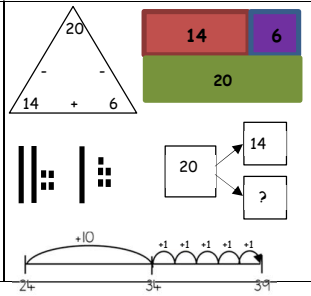
Variety is the spice of life. (Varied Fluency.)

We must ensure that children can experience calculations in a range of contexts, as they learn. Use money, or other measures, including time, to give calculations a context. *Apps/Challenges* could be contextualised problems, or the learning could be delivered through this to begin with. Any calculations done using shape, geometry or measure **must be put** into the appropriate area **on your maths display**.

Facts! Facts and more facts!

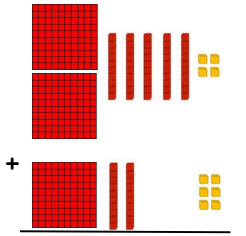
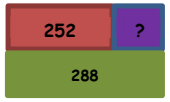
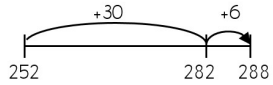
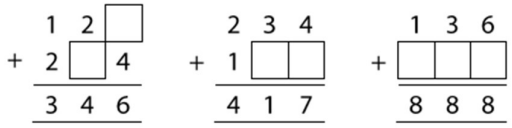
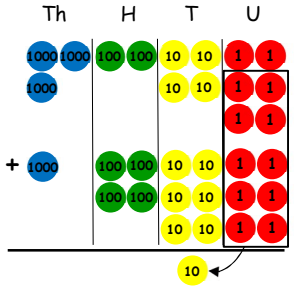
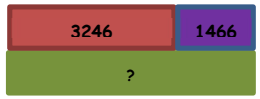
We must ensure that children are exposed to real-maths and related facts eg how many months in a year etc. The Maths Lead will provide a maths facts to discuss each week.

Addition	**Vocabulary:**	Count on, add, one more than, how many, altogether, greater than, 'and', sum, total, double, near double, plus, increase, round

Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
Early Yrs	What is 4 add 3? Count 4 cakes. Count 3 cakes. How many altogether?	 Use Numicon tiles, or concrete apparatus to find a total.	 	4 + 3 = 7 7 = 4 + 3	There are two people in a car and 2 more get in. How many people are in the car?
1	There are 4 people on a bus. 3 more get on. How many on the bus now? Count 4 cakes. Count 3 cakes. How many altogether?	 As reception, but introduce number tracks and position concrete apparatus on a track, pre-bar model.  Regrouping to make 10 on a tens frame. Use tens frame, counters and cubes to support counting on.	 	As Reception. Addition fact family: 4 + 3 = 7 7 = 4 + 3 Missing number equation: 4 + __ = 7 Adding two digit numbers to ones. Children see total amount first. 14 + 2 = 16 16 = 14 + 2	There are four children on the seesaw. Two children are on one side. How many children are on the other side? 
2	How many are 5, 8 and 7 altogether? What must I add to 14 to make 20? What is 24 add 15?	  Use Dienes to reinforce place value when adding 2-digit numbers – set out as columnar	 	8 + 7 + 5 = __= 8 + 7 + 5 Use linear number sentences: children to find bonds they know. 20 + 4 + 10 + 5 30 + 9 = 39	Jessica writes… 23 + 10 = 32 Without telling her the answer, can you explain how you know she's wrong?

		addition. Also use hundred squares and number tracks.	Continue to use fact families, bar models and other number fact representations. Also count in tens on a number line.	Use this pre-columnar addition to reinforce place value. Children will apply their understanding of place value to addition and begin to partition 2-digit numbers and add in a vertical form.	

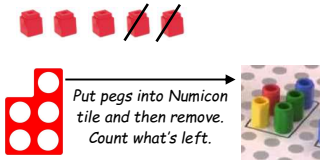
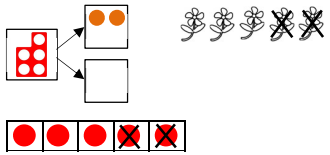
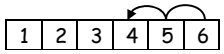
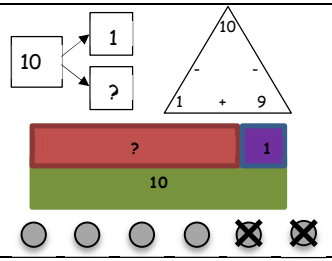
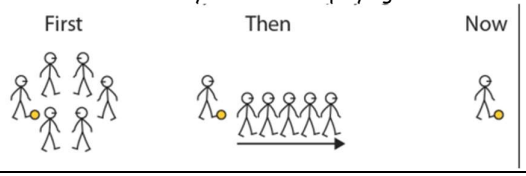
Addition	**Vocabulary:**	Count on, add, one more than, how many, altogether, greater than, 'and', sum, total, double, near double, plus, increase, round

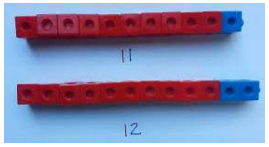
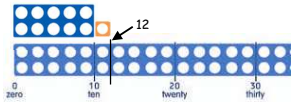
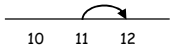
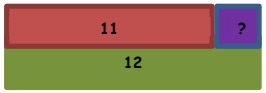
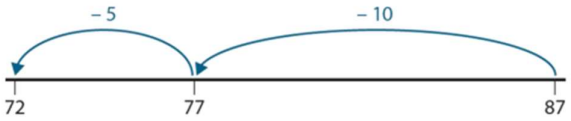
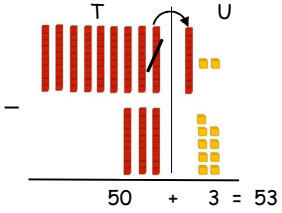
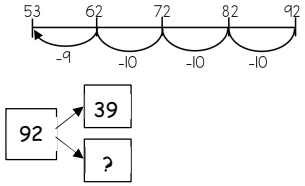
Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
3	Find the total of 254 and 126? Find the difference between 252 and 288?	 300 + 70 + 10 =	  Continue to use fact families and other pictorial representations.	200 + 50 + 4 + 100 + 20 + 6 300 + 70 +10 = 380 Expanded columnar addition supports the concept of place value, leading to formal columnar addition with carrying. 254 + 126 380 1	Fill in the blanks. 
4	Add 3246 to 1466?	 *Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.* Place value counters support working with greater numbers.	 The bar model and the number line continue to support addition.	**3246** **+ 1466** **4712** 1 1 Formal written methods will combine numbers according to their place value. Numbers with up to 2d.p. will be added, in the context of money.	 Choose two items and find the total cost. Choose three items and find the total cost.

5 6	54137 people live in one city. In another there are 3000 and 786 live in a third. How many people are there living in the three cities?	Children will continue to use place value counters to support place value when calculating with greater numbers.	The bar model will continue to be used, as will number lines and other pictorial representations.	Children will use formal written methods. Numbers with differing numbers of digits (e.g. 54137, 3000 and 786) will be added to continue to support place value.	Estimated populations of UK local authorities: **Name** / **Mid-2016 population** London 8,770,000 Birmingham 1,128,000 Leeds 781,000 Glasgow 615,000 Sheffield 574,000 Manchester 541,000 Edinburgh 507,000 Liverpool 488,000 Bristol 456,000 Cardiff 361,000 Leicester 350,000 Nottingham 325,000 Leeds and Sheffield are both in Yorkshire. What is the combined population of these two cities?

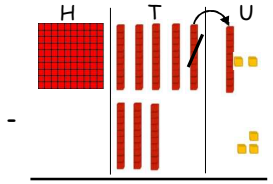
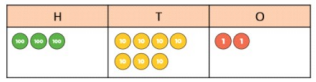
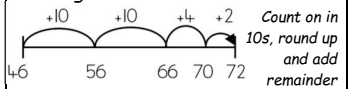
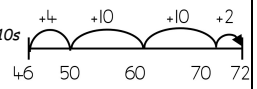
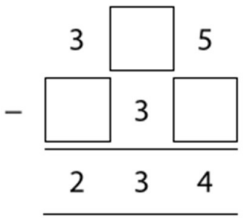
Subtraction

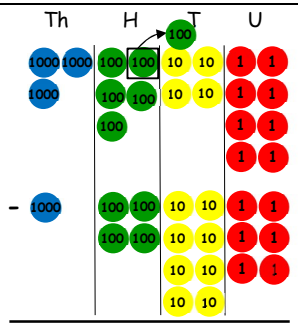
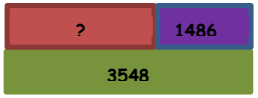
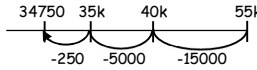
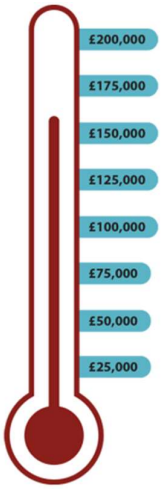
Vocabulary: Count back (from, to), take (away), low many are left/left over, less, count on, difference, decrease, minus, remove.

Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
Early Yrs	What is 5 take away 2?	 Use concrete apparatus to take away.	 Visual representations of taking away objects, as well as supporting inverse.	5 – 2 = 3 3 = 5 - 2	There are 5 cakes and Jess eats 2. How many are left?
1	There are 10 children. One goes out. How many are left? We made 6 mince pies. We ate 2. How many are left?	 Use number tracks and begin to use hundred squares to count back. Continue to use concrete apparatus.		10 – 1 = 9 9 = 10 - 1	First there were six children playing. Then five children went home. How many children are playing now? 

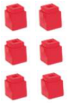
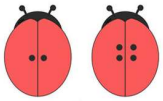
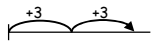
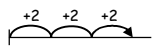
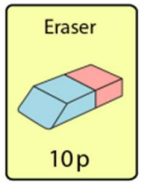
2	***Difference*** Lisa is ____ years old. Her sister is ____ years old. Find the difference in age between them.	 Cubes and Numicon can be used to reinforce the 'difference'. 	 Count on to find the difference, or use the bar model to represent differences. 	12 – 11 = 1 12 - __ = 11 11 = 12 - __ Finding the difference can be used to support subtracting two numbers which are 'close together'. This will support mental calculations involving single and 2-digit numbers.	James has 87p. He spends 15p at the shop to buy sweets. How much does he have left?  
	Count back or take away 92 subtract 39.	 Use Dienes to support taking away using columnar addition.	 Representations will support counting back, or require a method that uses take away.	$\overset{80}{\cancel{90}}\ \overset{1}{+}2$ $-\ 30 + 9$ $50 + 3 = 53$ Expanded subtraction supports the place value of 2-digit numbers.	

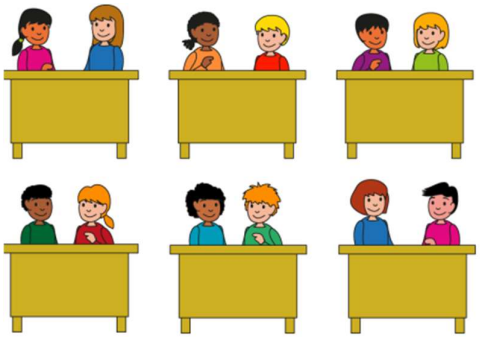
Subtraction	**Vocabulary:**	Count back (from, to), take (away), low many are left/left over, less, count on, difference, decrease, minus, remove.

Year	**Examples**	**Concrete**	**Pictorial**	**Abstract**	**Examples of going deeper (Dong Nao Jin) or real-world context**
3	Find the difference between 72 and 46? What is 152 minus 33?	 Use Dienes to support place value when taking away using columnar addition. 	Consider different ways of finding the difference:  *Count on in 10s, round up and add remainder* *Round up, count on in 10s and add remainder*  Continue to use the bar model and taking away on a number line.	Expanded method in year 2 leads to compact method with rearranging: $1\overset{4}{5}\overset{1}{2}$ $-\ 3\ 3$ $1\ 1\ 9$	What could the missing numbers be? What could they not be? How do you know? 

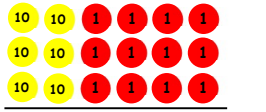
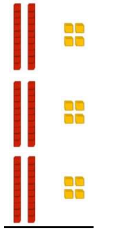
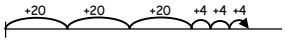
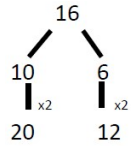
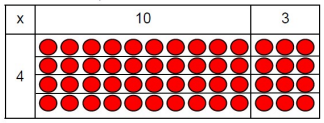
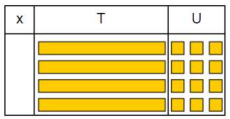
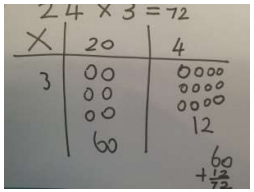
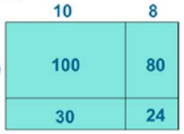
4	Subtract 1486 from 3548? Find the difference between 199 and 500?	 *Subtract by considering the difference, covering counters, or removing together.* Place value counters support working with greater numbers.	 Continue to use the bar model and a number line to represent and support subtraction.	Numbers with up to 2d.p. will be subtracted, in the context of money. Children should be encouraged to consider whether columnar subtraction is most efficient. $\begin{array}{r} {}^{4}\cancel{5}{}^{9}\cancel{1}{}^{1}\cancel{0}0 \\ -\,1\,9\,9 \\ \hline 3\,0\,1 \end{array}$ Using columnar subtraction is not necessarily the most efficient. Instead, children could round 199 to 200, take that away and then add 1. Alternatively, count on from 199 to 500.	What could the missing numbers be? What could they not be? How do you know? $\begin{array}{r} \square,7\square 8 \\ -\;1,\square 5\square \\ \hline 3,0\,7\,5 \end{array}$
5 6	Subtract 20250 from 55000?	Children will continue to use place value counters to support place value when calculating with greater numbers.	The bar model will continue to be used, as will number lines and other pictorial representations.  *Use the number line to consider subtraction, taking away amounts in order to find a known multiple.*	Children will use formal written methods. Numbers with differing numbers of digits (e.g. 5486 subtract 721) will be subtracted to continue to support place value.	A charity aims to raise £200,000 So far it has raised £158,436. How much more does the charity need to raise to reach its target amount? 

Multiplication	**Vocabulary:**	Groups, sets, altogether, equals, count on, multiples, times, multiply, double, once, twice, three times etc., repeated addition, array, pairs, product, factors.

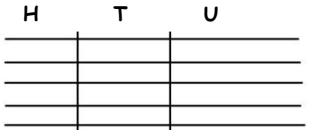
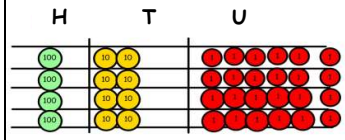
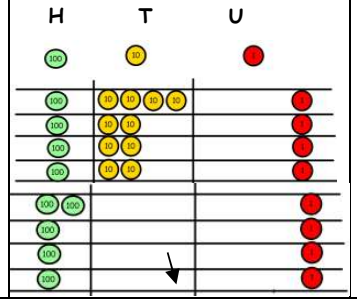
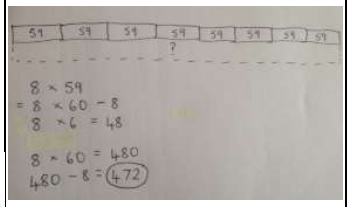
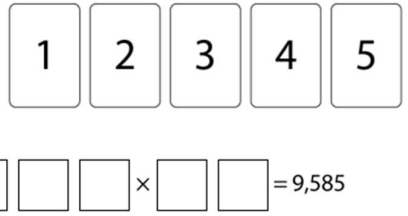
Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
Early Yrs.	Can you make 3 lots of 2? What is double 2?	  Children will use apparatus, to make 'lots of'. They see that a Numicon '2' tile has the same value as two objects – could be done by placing marbles on top of Numicon, for example.  Use apparatus to reinforce doubling. Classroom objects and familiar objects could be used to help further understanding.	Pictures of Numicon could be used to reinforce multiples. Ladybirds could be used to reinforce doubling.  Groups of objects could be shown, using shapes or simple outlines.	"Double 2 is 4" should be considered as "2 add 2 equals 4".	There are two birds sat on a branch. Two more birds join them. How many birds are there?
1	What are 2 lots of 3?	Children will continue to use Numicon, recognising a tile as representing a group. Groups of objects, such as cubes will also be used to secure the understanding of what a 'group', or 'set' is. Set these out in and use the language '*array*' **wherever possible.**	XXX XXX **Simple drawings.** Questioning continues to distinguish counting 'the groups' and 'altogether'. Also use drawn **arrays**. '3 x 2 =' represented as:   But also seeing that '2 x 3 =' has the same value, reinforcing the *commutative law.*	Children will begin to record multiplication number sentences themselves e.g. 3 x 2 = 6. Adding missing number equations into learning 3 x __ = 6 2 x __ = 6	How many pennies would you need to buy this eraser?   Ten lots one pence

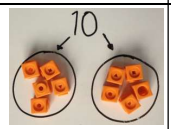
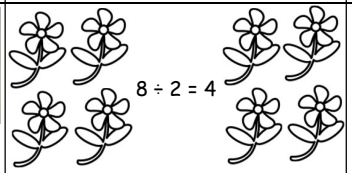
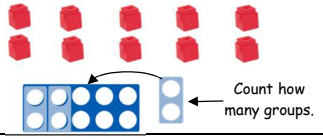
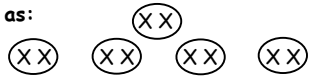
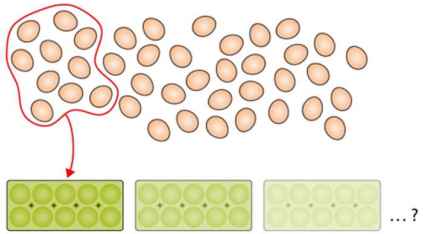
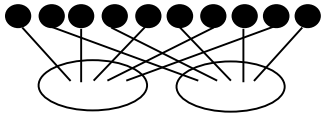
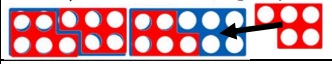
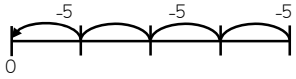
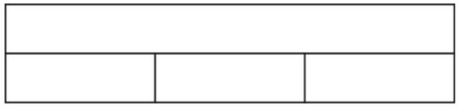
Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
2	I have 3 pairs of shoes. How many shoes do I have altogether?	Numicon and cubes will continue to support multiplication: Numicon reinforcing groups; cubes reinforcing arrays and *commutativity*. Place value counters could begin to reinforce multiplication with greater numbers e.g. 10 x 4 = 10 10 10 10	**Arrays** set out by children support the concept of multiplication being commutative (e.g. 3 x 2, or 2 x 3). Children will be asked to group objects by drawing round them: 'Real life' objects could also be used during this activity e.g. using pencils and	Children will record and identify multiplication as repeated addition: 2 + 2 + 2 = 6 2 x 3 = 6	Agree or disagree? This shows 2x6 

Multiplication	**Vocabulary:**	Groups, sets, altogether, equals, count on, multiples, times, multiply, double, once, twice, three times etc., repeated addition, array, pairs, product, factors.

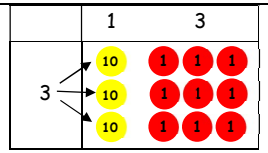
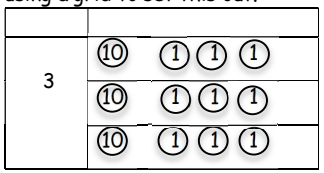
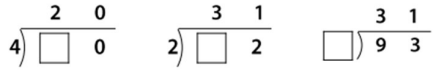
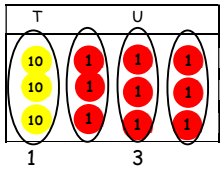
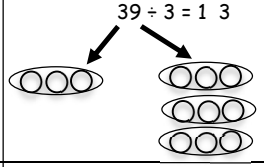
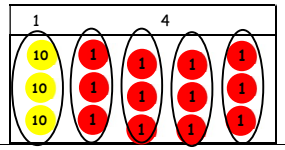
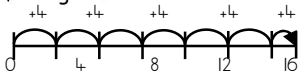
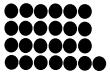
Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
3	What is 24 multiplied by 3? What is 40 times 3?	Use concrete apparatus to show the groups. Use counters:  60 + 12 = 72 Or Dienes:  60 + 12 = 72	Use pictorial representations of the concrete apparatus. Also use the number line:  	Children will partition a number, double each part and then recombine.  Use smile multiplication to multiply numbers with lots of '0s'. This supports mental calculations: 40 x 3 = 120 12 **24** **X 3** **12 (U x U)** **60 (U x T)** **72** Use expanded multiplication to support place value.	Sam used the strategy of partitioning the two digit number into tens and ones to do this multiplication. 25 x 7 Which of these calculations did he use to find the product? Explain your reasoning. 140 + 35 70 + 70 + 35 147 + 28 100 + 75 Fill in the missing number 4 1 × □ = 8 2 □ 2 × 4 = 4 8 □□ × 4 = 8 8
4	Calculate 13 x 4? 24 x 3 is? Multiply 18 by 13?	Use arrays (physical or drawn) in the grid to show how the number is calculated.  Use dienes in a place value grid to show multiples of a number 13 x 4 =  	Use pictorial representations of physical apparatus including sketching of grid method with Dienes and place value counters:  	Use numbers in the grid method: | x | 10 | 3 | | 4 | 40 | 12 | 40 + 12 = 52 Progress to 2-digit x 2-digit numbers:  **123** **X 4** **12 (U x U)** **80 (U x T)** **400 (U x H)** **492** **Formal written methods** multiplying units by units, tens, then hundreds. **123** **X 4** **492** 1 **Progressing to** short multiplication with carrying of greater digits.	Fill in the missing digits. How many solutions are there for each problem? 1 □ 7 × □ = 8 2 2 1 5 □ × 6 = □□ 4

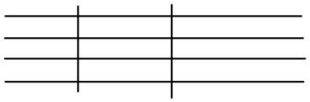
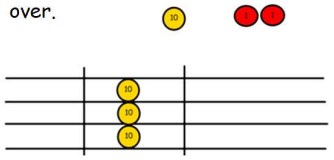
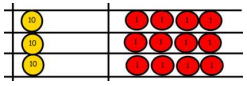
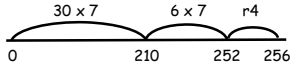
Multiplication	**Vocabulary:**	Groups, sets, altogether, equals, count on, multiples, times, multiply, double, once, twice, three times etc., repeated addition, array, pairs, product, factors.

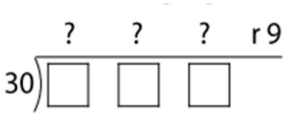
Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
5 6	Find 126 x 4? Calculate 4924 multiplied by 23?	**Concrete apparatus** will support the concept of exchanging when necessary. 126 x 4: We are multiplying by 4 so we need 4 rows.  Fill each row with 126.  Add up each column, starting with the ones making any exchanges needed. Then you have your answer.  	Use the bar model or number lines to support problem solving. E.g. Sara made a bridge using 8 pieces of straw. Each piece of straw was 59cm long. How long was the bridge?  	**Formal written methods** multiplying units by units, tens etc. 4924 X 23 14772 98480 113252	Use these five number cards to create a multiplication equation. What could this equation be? 

Division	**Vocabulary:**	Count, share, group, remainder, divided by, divisible by, divided into, quotient, shared equally			
Year	**Examples**	**Concrete**	**Pictorial**	**Abstract**	**Examples of going deeper (Dong Nao Jin) or real-world context**
Early Yrs	I have 10 cubes, can you share them equally in 2 groups?	  Share objects into a given number of groups. Prior to grouping in order to divide, children will count number of groups. *How many groups of 2 are there?'* 	 Children use pictures or shapes to share quantities.	"Half of 10 is 5."	There are 10 cars parked on a car park. Half of the cars drove away. How many are left?
1	**Dividing by grouping** 10 socks were put into pairs. How many pairs of socks were there?	**Concrete apparatus** allow children to split a number into groups of equal size. 	10 ÷ 2 = 5 (read as, "10 split into groups of 2 equals") **Pictorial representations such as:** 	10 ÷ 2 = 5 (This could be read as meaning, '10 split into groups of 2'.)	A farmer has forty eggs. She can fit ten eggs in a box. How many boxes does she need? 
	Dividing by sharing Split this number into groups of 2?	Continue to use cubes and other objects to share between a given number of groups.	 A set is drawn and then shared with arrows/lines into groups.	10 ÷ 2 = 5 (This could also be read as meaning, '10 shared between 2'.)	
2	**Dividing by grouping** There were 20 children in a class. Each table had 5 chairs around it. How many tables were needed?	Continue using Numicon to support dividing by grouping: identify the size of groups ('5') and lay it on the set ('4 groups'). 	Use numbers line to demonstrate repeated subtraction – taking the same group each time. 	20 ÷ 5 = 4 Record as a linear number sentence and encourage children to begin using their times tables to count up in groups, counting how many groups are needed.	True or false? This bar model can only be used to represent six divided into three groups of two 
	Dividing by sharing What is 20 shared between 5?	As in year 1, physically share objects among groups.	Use arrays to divide by sharing.	Again, record as a linear number sentence, but use 'grouping' as fall back mental calculation .	

Division	**Vocabulary:**	Count, share, group, remainder, divided by, divisible by, divided into, quotient, shared equally

Year	Examples	Concrete	Pictorial	Abstract	Examples of going deeper (Dong Nao Jin) or real-world context
3	**Division by sharing where the tens and units will share equally with no exchanging.** What is 39 divided by 3? 39 ÷ 3 = *What is thirty-nine shared between 3?*	 Use counters and partitioning to share larger numbers without exchanging.	A visual representation of counters, but progressing to using a grid to set this out.  		Fill in the missing digits 
	Division by grouping where the tens and units will share equally with no exchanging. What is 39 divided by 3?	 *How many groups of 3 can you make with the tens?* *How many groups of 3 can you make with the units?*	**Number lines** can once again reinforce the grouping of objects. *Use the same language as in concrete.*  	**Bus stop** can be used alongside concrete apparatus when grouping. T U 1 3 3) 3 9 Language used is as with concrete apparatus: *how many groups of 3 can you make with these tens? How many groups of 3 can you make with these units?*	
	Division by grouping with exchanging. What is 42 divided by 3?	First, group the tens according to the divisor, then exchange the left over 10 for ten ones. *Count how many groups of 10s and how many groups of 1s.*  	**Number lines** or **drawing of counters** can be used to represent concrete apparatus.	**Bus stop** can be used with concrete apparatus to exchange. T U 1 4 3) 4 12 The ten is exchanged for ten ones and is recorded in the units' column.	
	Division by grouping with exchanging and remainders. 25 ÷ 4 =	Counters can again be used. For this example, exchange the two tens for twenty ones. Then group the 25 ones into groups of 4. Put the remainder to one side.	**Number lines** may support in finding remainders:  **Arrays** (including remainders): 	**Formal written methods** first divide a single digit number into a tens number, then into units, including remainders. 0 6 r1 4) 2 2 5	

Division	**Vocabulary:**	Count, share, group, remainder, divided by, divisible by, divided into, quotient, shared equally			
Year	**Examples**	**Concrete**	**Pictorial**	**Abstract**	**Examples of going deeper (Dong Nao Jin) or real-world context**
4	Divide 42 by 3? Is 172 divisible by 4? ***Look at order of teaching for Year 3 and revise as necessary!***	Use place value counters to divide using the bus stop method alongside: 42 ÷ 3=   Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.  We exchange this ten for ten ones and then share the ones equally among the groups.  We look at how many are in 1 group: the answer is 14.	**Number lines** and **arrays** continue to support children in their multiplication. **Number lines** can be used to reinforce mental calculations e.g. 257 ÷ 7 = Estimate first, using times tables knowledge and a number line to count on.  	**Formal written methods** begin to include dividing single digit numbers into 3-digit numbers: $4\overline{)1^{1}7^{1}2}$ 0 4 3 Decimals introduced in the context of money. **Formal written methods with remainders expressed as fractions** should also be introduced if children are confident. e.g. 43 ÷ 2 = 21 r1 or 21 ½ when the ½ means one out of two equal parts that we were dividing by.	Fill in the missing digits $3\overline{)\square\,{}^{1}4}$ 1 4r2 $\square\overline{)\square\,{}^{1}5}$ 1 2r3

Division	**Vocabulary:**	Count, share, group, remainder, divided by, divisible by, divided into, quotient, shared equally			
Year	**Examples**	**Concrete**	**Pictorial**	**Abstract**	**Examples of going deeper (Dong Nao Jin) or real-world context**
5	256 people were travelling by minibus to a football match. Each minibus could carry 17 people. How many minibuses did the people need?	Use physical apparatus, especially counters, to reinforce how the bus stop method works.	Use **number lines, arrays**, and pictorial representations of **counters** to support calculations. The **bar model** can support problem solving when dividing.	**Long Division HTU ÷ TU; ThHTU ÷ TU** Children first calculate known multiples in order to 'chunk': 1 x 17 = 17 2 x 17 = 34 5 x 17 = 85 10 x 17 = 170 Then use this to subtract 'chunks' of the number: 10 + 5 = 15 r 1 e.g. 17)2 5 6 1 7 0 (10 x 17) 8 6 8 5 (5 x 17) 0 1 16 minibuses needed.	Fill in the missing digits in the boxes. How many solutions can you find? 
6				**Long and short division with decimals and expressing remainders as fractions or decimals.** 15 1/17 e.g. 17)2 5 6 1 7 0 6 6 5 1 1 5 1 4 . 4 e.g. 5) 7 2 . 0	Refer to parts of bus stop number sentence and use same language when referring to fractions – this language may need to be interchangeable.