Primet Primary School

Concrete, Pictorial and Abstract Calculation Policy

Recommended practice delivering a mastery approach

True mastery aims to develop all children's mathematical understanding at the same pace. As much as possible, children should be accessing the same learning. Differentiation should primarily be through support, scaffolding and deepening, not through task.

Consistency in language is essential for pupils to understand the concepts presented in mathematics. If other, 'child-friendly' terminology is used, this must be alongside the current terminology recommended by maths specialists. Using this will support children with their examinations and throughout secondary school.

Evidence repeatedly shows that mixed ability seating increases less confident pupils' perception of mathematical capability, which impacts positively upon outcomes.

Concrete, pictorial, abstract (CPA) concepts should not be confused as differentiation for lower, middle, higher attaining children. CPA is an approach to be used with the whole class and teachers should promote each area as equally valid.

Times tables

Times tables to be taught formally for 5 to 10 mins at the beginning of each maths lesson. A demonstration of the approach can be found below:
https://www.youtube.com/watch?v=yXdHGBfoqfw

Years 1 – 2, 5 and 10
Year 2 – 2, 5 and 10 including division facts
Year 3 – 2, 5, 10, 3, 4 and 8 including division facts
Years 4 to 6 – all times tables including division facts (12 x 12)

Within key stage 2 , children to develop fluency and variation of times table based upon known facts as appropriate to year group expectation for multiplication (see grid multiplication e.g year 3 – multiples of 10 x by digit to support 2 digit x single digit multiplication):

e.g
4 x 3 = 12
So
40 x 3 = 120
4 x 30 = 120
400 x 3 = 1200 etc

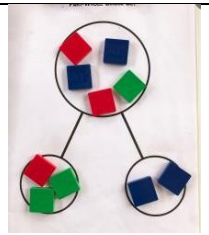
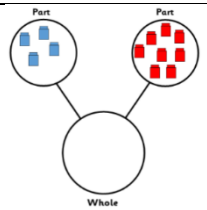
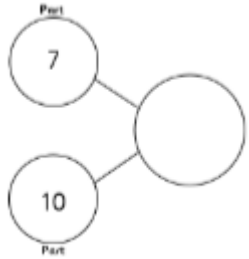
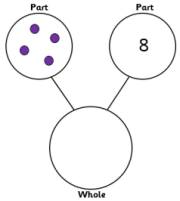
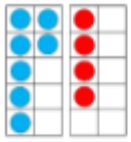
And
0.4 x 3 = 1.2
4 x 0.3 = 1.2
0.04 x 3 = 0.12
etc

Children to be tested weekly on times table for that week.

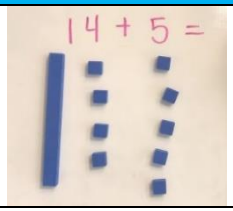
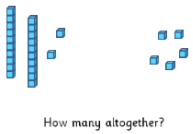
Representations used by Year Group (* INDICATES USE)

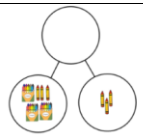
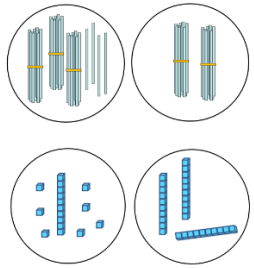
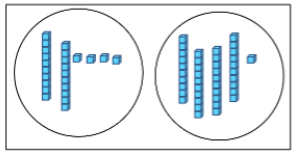
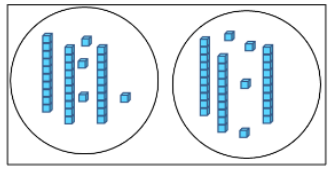
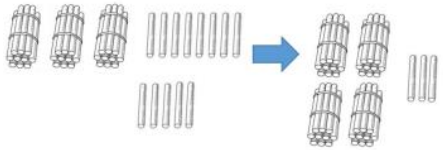
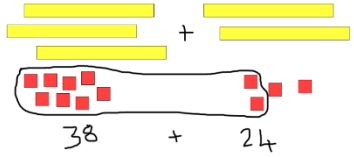
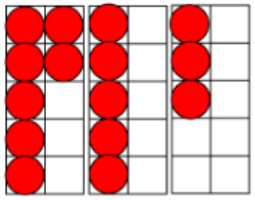
	Tens Frame	Part Whole	Sticks and Dots	Number Lines	Place Value	Bar Models
EYFS	*	*				
Y1	*	*	*	*		
Y2	*	*	*	*		*
Y3	*	*	*	*	*	*
Y4	*	*	*	*	*	*
Y5	*	*	*	*	*	*
Y6	*	*	*	*	*	*

Year 1 Addition

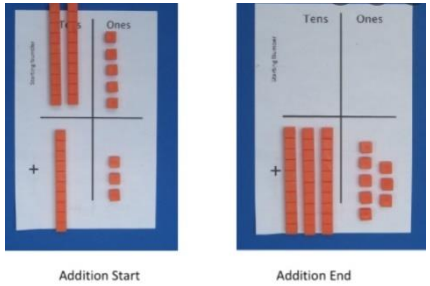
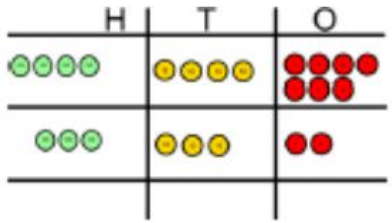
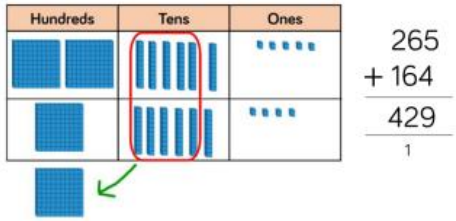
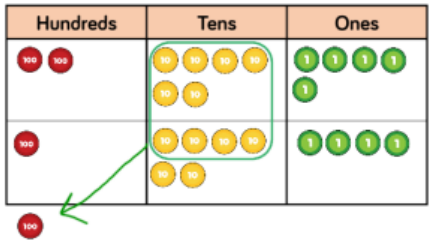
Objective	Concrete	Pictorial	Abstract
Combining two parts to make a whole – part, part, whole.	 Use of cubes or other manipulatives.	 ___ + ___ = ___ Simple pictures or symbols to represent numbers.	
Starting with the bigger number and counting on.	 Starting with the bigger number and counting on 1 by 1.	7 +  = ___ Larger part identified. 	7 + 5 = ___ ___ = 7 + 6
Regrouping to make 10.	 Start with bigger number and use number bonds to make ten.	 7 + 4 = ___ 7 + 3 + 1 **10** + 1 = ___	4 + 7 = ___ ___ + ___ + ___ ___ + ___ = ___

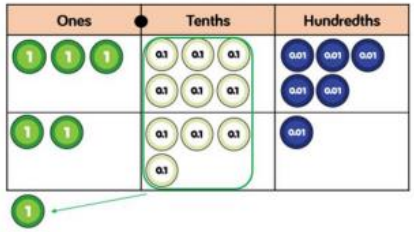
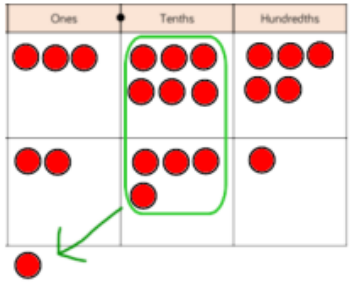
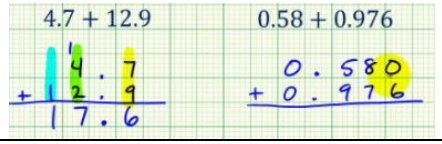
Year 2 Addition

Addition of 1 digit number to a 2 digit number	 Use of base ten, tens frames and straws.		54 + 4 =

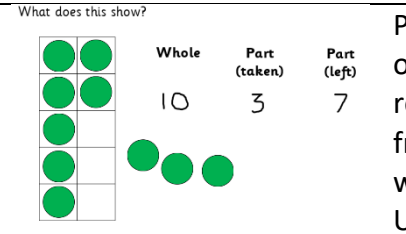
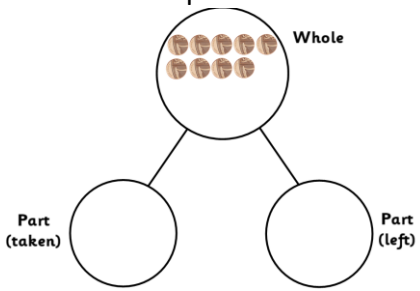
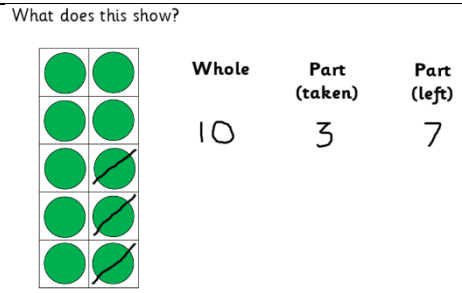
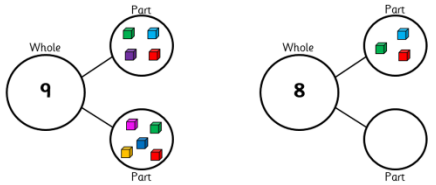
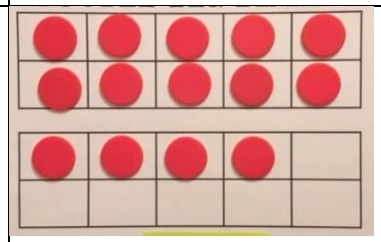
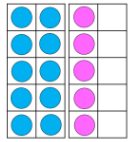
		 33 + 3 = _____	
Adding multiples of ten to a 2 digit number.	 25 + 10 = 35	 34 + 20 = _____ _____ + 30 = _____	23 + 20 = _____ 52 + 30 = _____ _____ = 50 + 48
Addition of two 2 digit numbers (without bridging 10)	 Use of base 10 and stick bundles 24 + 41 = _____	 _____ + _____ = _____	23 + 13 = 23 + 10 + 3 = 33 + 3 = 36
Addition of 1 digit number to a 2 digit number (bridging 10) Exchanging NB – children need to know and be secure that 10 ones can be represented by a ten – bundle or rod)	 Use of manipulatives (straws, tens frames and base 10) Regroup of ten.	 = 62 Children to draw the regrouped ones to form a ten then add the remaining ones.	46 + 7 36 + 65
Addition of three single digit numbers	 Children to form groups of ten first and then add third number.	 7 + 5 + 3 = _____	9 + 5 +1 = _____ 3 + 5 + 7 = _____

Year 3 Addition

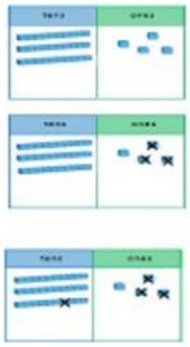
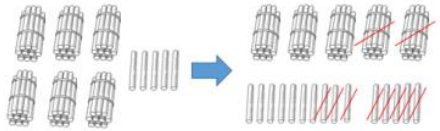
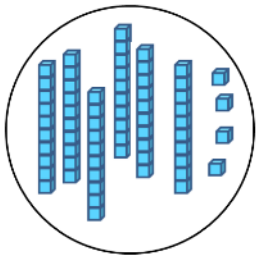
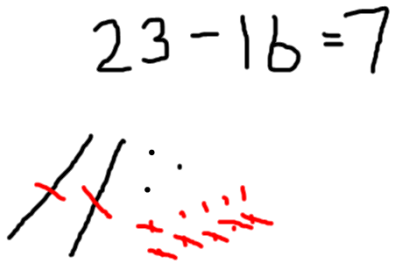
Column addition without exchange	 Addition Start Addition End 25 + 13 Moving onto use of place value counters	 Display the coulum written method alongside the place value chart repsresentation.	2 2 3 + 1 1 4 3 3 7 Adding the ones then the tens and then the hundreds.
Column addition with exchange	 265 + 164 429 1 	As concrete model using printed place value charts and children representing numbers on charts with circles.	265 + 164 429 1
Year 4 to 6 Addition			
Addition of two 4-digit numbers or greater.	Children will continue to add increasingly larger numbers as per year 3 guidance Year 4 – up to four digits Year 5 and 6 - more than four digits.		

Adding decimals	 Use of place value charts	 Drawing own representations	$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$ When adding numbers with different amounts of decimal places, ensure that place holders are included. 

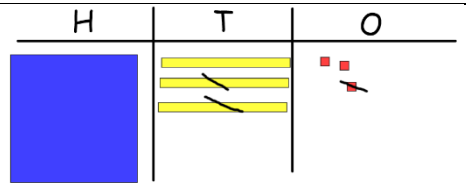
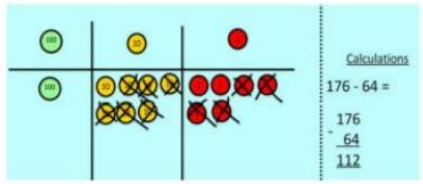
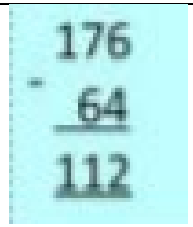
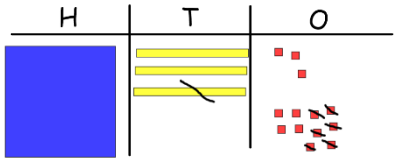
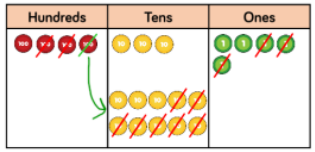
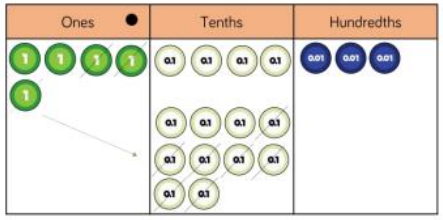
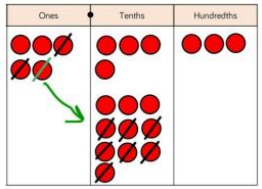
Year 1 Subtraction

Objective	Concrete	Pictorial	Abstract
Taking away ones (Link with addition and number bonds used in part whole models to show inverse)	 Physical objects removed from a whole. Use of tens frame and part whole model. 	 Crossing out of the part to be taken away.  ___ – ___ = ___ ___ – ___ = ___ Link to part whole model as inverse of addition.	10 – 4 = ____ 8 – ____ = 3
Making 10	 14 – 6 = Take away the four to make ten and then the other two counters.	 15 – 7 = ____ 15 – 5 – 2 **10** – ____ = ____	14 – 6 = ____ 14 – ____ – ____ **10** – ____ = ____ 13 – 9 = ____ ____ – ____ – ____ ____ – ____ = ____

Year 2 Subtraction

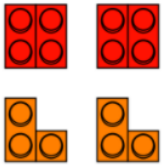
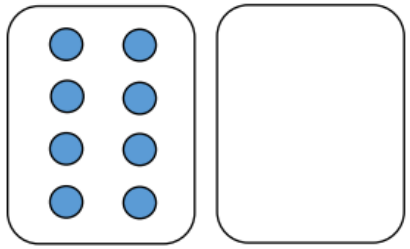
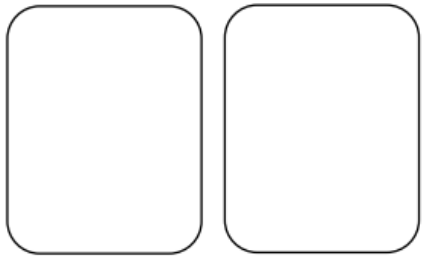
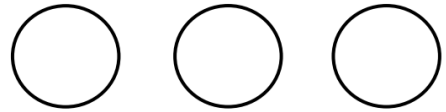
Subtracting a 1-digit or 2-digit number from a 2-digit number without exchanging	34—13 = 21  Use Dienes to show how to partition the number when subtracting without regrouping.	 43—21 = 22 Children to draw their own representation of base ten.	43—21 = 22
Subtracting using exchange	 Children to be made aware that bundles may need to be separated to be able to subtract. This moves on to the use of base 10 equipment.  64 – 15 = _____	 Children to draw their own representation of base ten and then cross out accordingly.	23 – 16 = 7

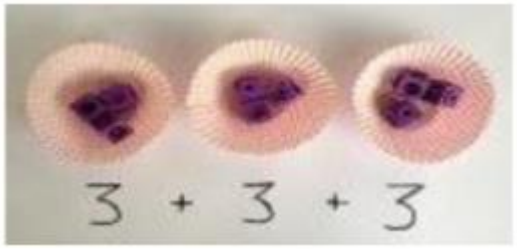
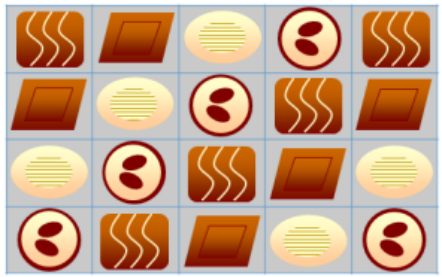
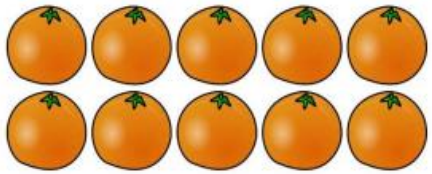
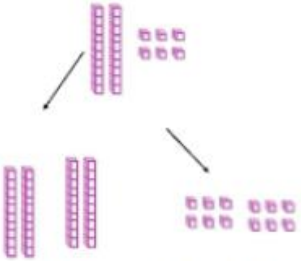
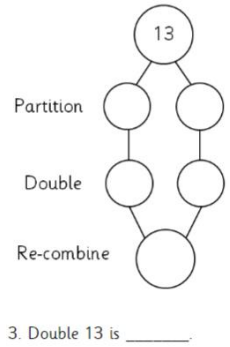
Year 3 Subtraction

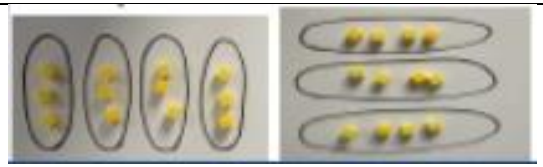
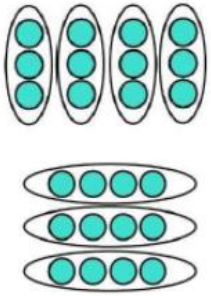
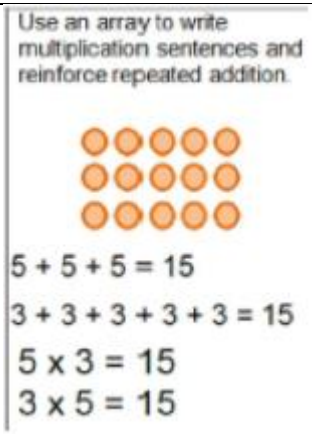
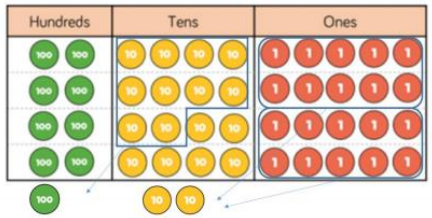
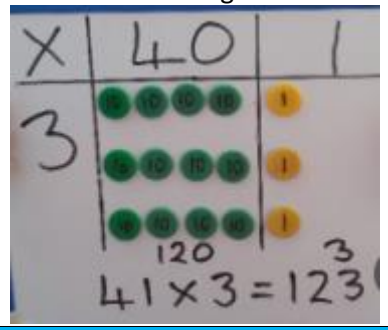
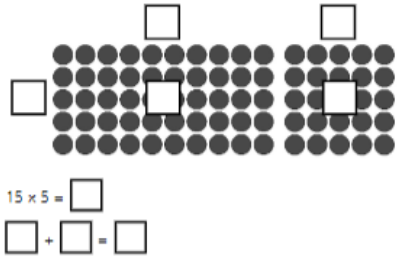
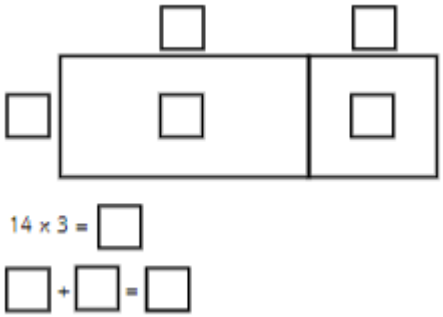
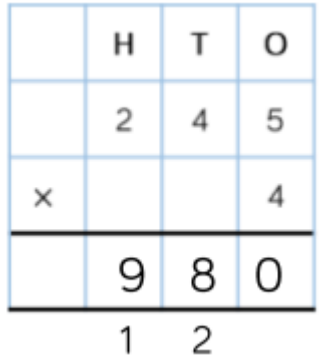
Subtraction without exchange	 133 − 21 Children to use base 10 and place value charts and then move on to the place value counters.		
Subtraction involving exchange	 133 - 26 Children to use base 10 and place value charts and establish concept on exchange then move on to the place value counters.	3 1 435 − 273 262  Draw own representations to support calculation.	3 1 435 − 273 262
Year 4-6 Subtraction			
Subtracting decimals	 Use of place value charts	 Draw own respresentation	4 1 5.43 − 2.7 2.73

Children will continue to subtract increasingly larger numbers as per year 3 guidance
Year 4 – up to four digits
Year 5 and 6 - more than four digits.

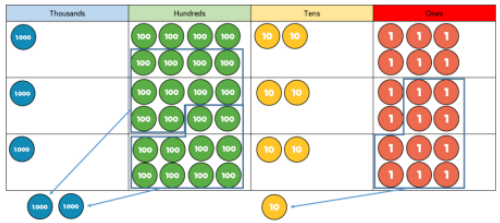
Year 1 Multiplication

Objective	Concrete	Pictorial	Abstract
Doubling	 4 + 4 = ☐ 2 × 4 = ☐ 3 + 3 = ☐ 2 × 3 = ☐ Use of manipulatives to demonstrate doubling	**Double 8 is _____**  **Double 6 is _____** 	8 x 2 = 6 x 2 =
Making equal groups and counting the total.	 Use manipulatives to make equalt groups and then count up	There are _____ flowers in each of _____ pots.  How many flowers are there altogether? _____	There are two bananas in each bowl. How many bananas are there altogether? _____  3 x 2 =

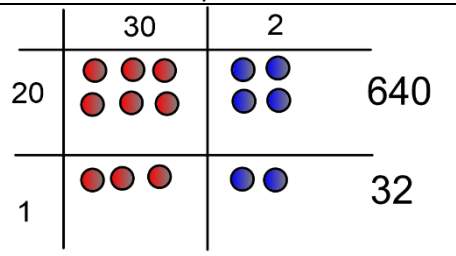
Repeated addition	 Different objects used to add equalt groups	 There are 5 chocolates in each row. There are 4 rows. How many chocolates altogether? _____chocolates	5 x 4 = 5 + 5 + 5 + 5 =
Use of arrays	 Use manipulatives to create arrays to respresent multipliucation then count.	 5 x 2 =	5 x 2 =
Year 2 Multiplication			
Doubling	Physical doubling with objects to represent a single digit moving to two digit numbers using base 10. 	Draw representtations of their own to show the doubling and use of sticks and dots to represent base 10.	 Moving onto: Double 23 and 23 x 2=

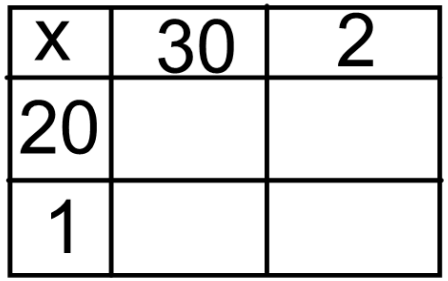
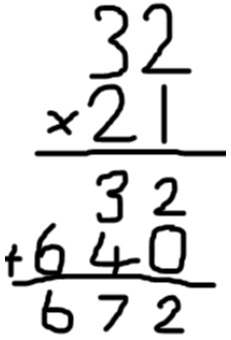
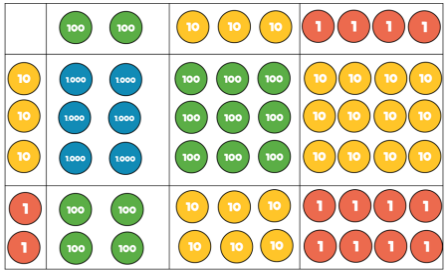
Use of arrays to show that multiplication is commutative	 Creating arrays using counters or other objects.	 Explore arrays to create calculation and show the commutativity.	
Year 3 and 4 Multiplication			
Multiplication of 2 and 3 digit number by a single digit (Year 3 – 2 digit by 1 digit) (Year 4 – 3 digit by 1 digit)	 Use of place value chart using base ten or counters froming the array and then adding from the ones This builds to the grid method 	 Moving to 	$245 \times 4 = 980$ Using formal column method 
Year 5 and 6 Multiplication			

<table>
<tr>
<td>Multiplication of 4 digit number by single digit

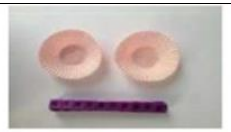
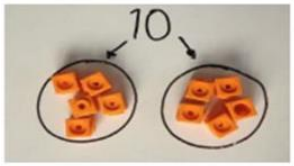
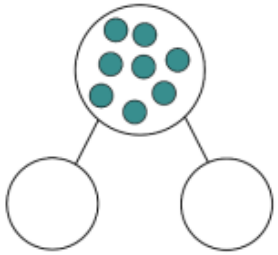
This method to also be used when multiplying decimals</td>
<td> 
1826 x 4 =

Children to create own array using place value counters on place value chart.</td>
<td>Own representation on place value chart with formal column method alongside.</td>
<td>1,826 × 3 = 5,478

<table>
<tr><td></td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>1</td><td>8</td><td>2</td><td>6</td></tr>
<tr><td>×</td><td></td><td></td><td></td><td>3</td></tr>
<tr><td></td><td>5</td><td>4</td><td>7</td><td>8</td></tr>
<tr><td></td><td>2</td><td></td><td>1</td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>Multiplying a 2 digit number by a 2 digit umber</td>
<td> 
32 x 21= 640 + 32 = 672

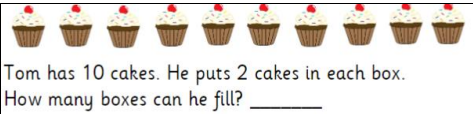
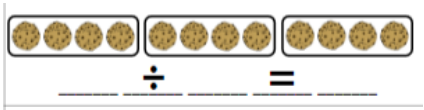
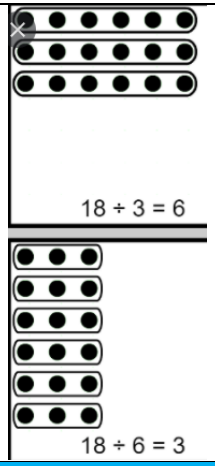
Use of counters on a grid</td>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td>Multiplying a 3 digit number by a 2 digit number</td>
<td> 
Use of counters on grid (Values can be written as numerals rather than place value)</td>
<td>
<table>
<tr><td>×</td><td>200</td><td>30</td><td>4</td></tr>
<tr><td>30</td><td>6,000</td><td>900</td><td>120</td></tr>
<tr><td>2</td><td>400</td><td>60</td><td>8</td></tr>
</table>
</td>
<td>
<table>
<tr><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>×</td><td></td><td>3</td><td>2</td></tr>
<tr><td></td><td>4</td><td>6</td><td>8</td></tr>
<tr><td>1 7</td><td>1 0</td><td>2</td><td>0</td></tr>
<tr><td>7</td><td>4</td><td>8</td><td>8</td></tr>
</table>
</td>
</tr>
</table>

Year 1 Division

Objective	Concrete	Pictorial	Abstract
Division as sharing into equal groups (halving)	   Physical sharing into equal groups of manipulatives	 $8 \div 2 =$	$8 \div 2 =$
Division as grouping		 Here are 22 seeds. 2 seeds go in each pot How many pots can be filled? _____pots Physically draw a ring around the group size then count the number of groups	22 ÷ 2 =

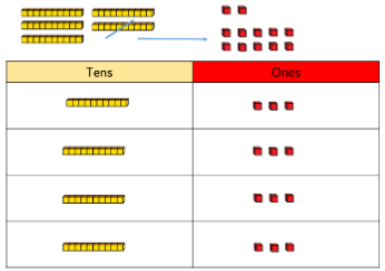
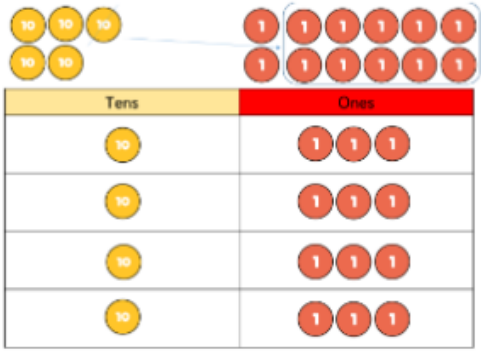
Year 2 Division

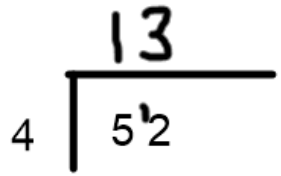
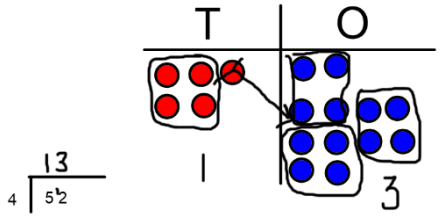
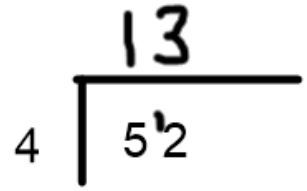
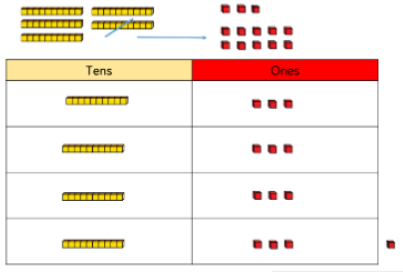
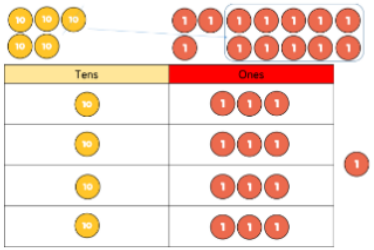
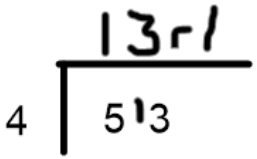
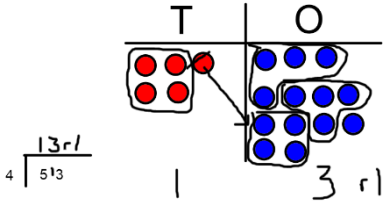
Division as sharing with a remainder	Children to physically share an amount between pots	 Children to draw and cross out when sharing. Children to move onto drawing own representations	13 ÷ 4 =

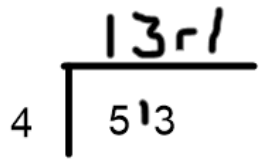
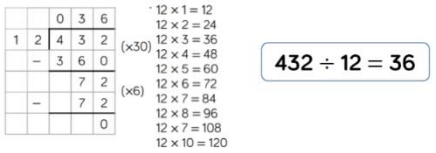
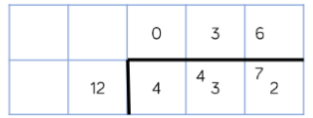
Division as grouping no remainder	 Children to physically draw around the groups.	As concrete method. Children to draw own representations. 	18 ÷ 3 = _____
Division as an array	 Children to have the arrays to then group Children to understand the inverse link to multiplication.	 _____ × 2 = _____ 2 × _____ = _____ _____ ÷ 2 = _____ _____ ÷ _____ = 2	18 ÷ 3 = _____

Year 3- 6 Division

The principles apply for division for Years 3 to 6 with ever increasing numbers:
Year 4 – 3 digits by 1 digit
Year 5 and 6 – 4 digits by 1 digit

Division by sharing with exchange	 Use of place value charts and base ten and counters physically moving counters and exchanging	Develop own representations using place value charts 	52 ÷ 4 = 13 Moving to bus stop method

			
Division by grouping with exchange	 Use of place value charts	As previous with children drawing own representation.	
Division by sharing withexchange and remainders	Use of place value charts and base ten and counters physically moving counters and exchanging 	 Develop own representations using place value charts	$53 \div 4 = 13\ r1$ Moving to bus stop method 
Division by grouping with exchange and remainders	 Use of place value chart	As previous with children drawing own representation.	$53 \div 4 = 13\ r1$ Moving to bus stop method

			
Year 6 Division			
Division of multiple digits by a 2-digit number. (Long division)	Concrete resources will not help this skill.	Pictorial representation do nothelp this skill but the writing of key multiple facts will provide a scaffold for children to use.	
Division of multiple digits by a 2-digit number. (Short division)	Concrete resources will not help this skill.	Pictorial representation do nothelp this skill but the writing of key multiple facts will provide a scaffold for children to use.	 Children to move to short division method as soon as possible to reduce the need for subtraction where mistakes could arise. 12 × 1 = 12 12 × 2 = 24 12 × 3 = 36 12 × 4 = 48 12 × 5 = 60 12 × 6 = 72 12 × 7 = 84 12 × 8 = 96 12 × 7 = 108 12 × 10 = 120