Plymouth Grove Primary School

Calculation Policy 2021

Sophie Turner 2021

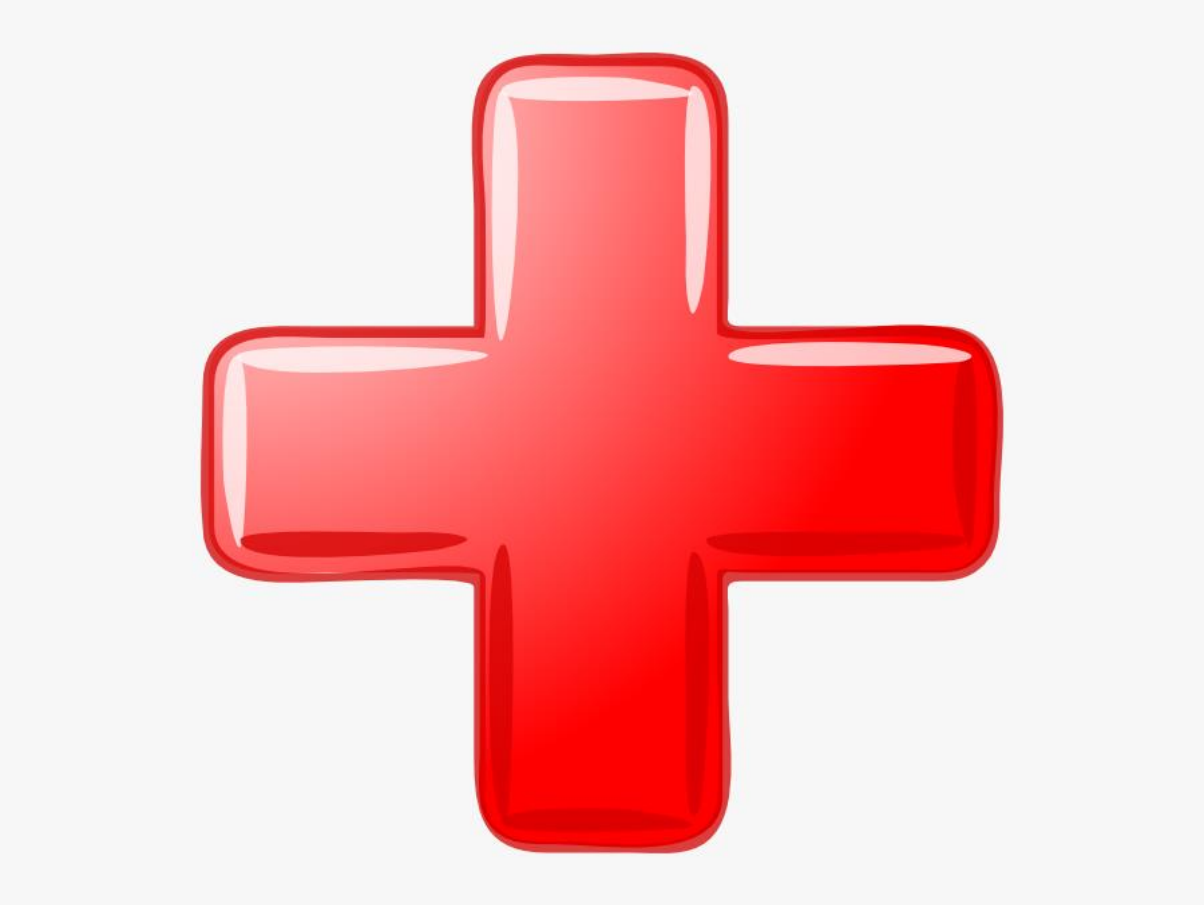
About this policy

The aim of this policy is to show how the four operations (addition, subtraction, division and multiplication) are taught at Plymouth Grove Primary School. The policy is based on the national curriculum objectives for each year group and ensures progression for pupils throughout their time at Plymouth Grove.

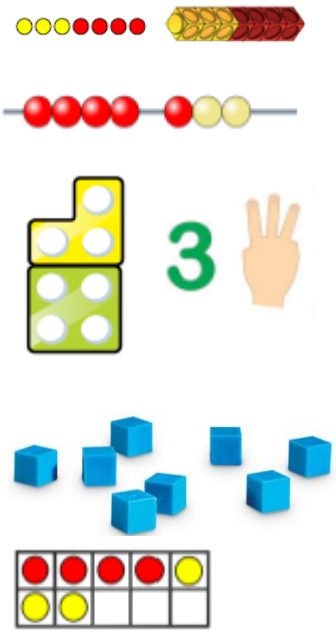
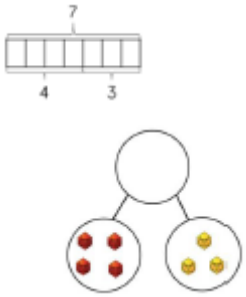
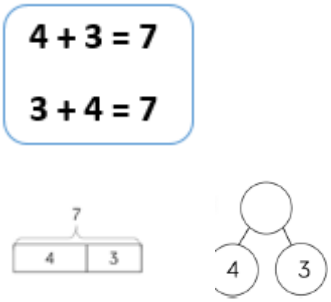
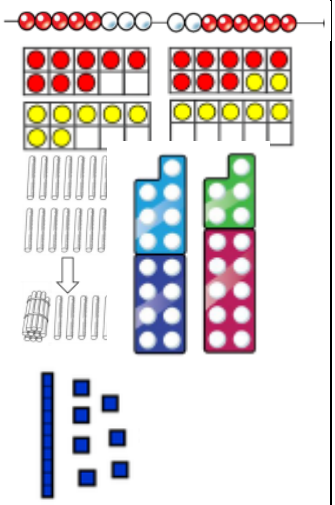
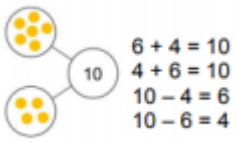
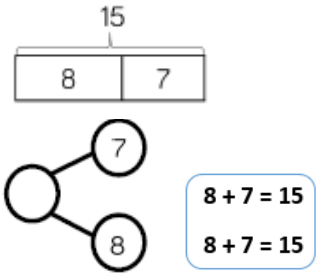
The policy is designed to promote a concrete, pictorial, abstract approach to learning. This allows pupils to have a strong understanding of number before moving onto more abstract methods for solving calculations. The policy helps to develop a link between the different phases of understanding, so pupils are able to move on from concrete representations to more efficient methods of solving calculations.

The policy is based on the White Rose Maths calculation policy. This scheme is used throughout Plymouth Grove Primary School for teaching mathematics.

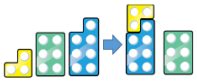
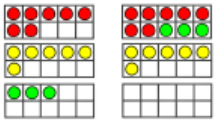
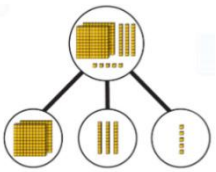
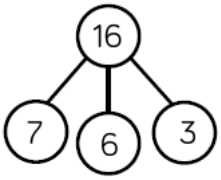
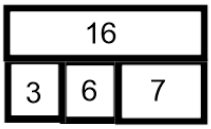
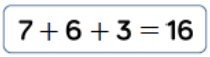
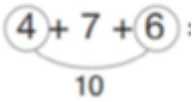
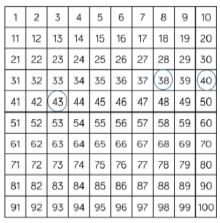
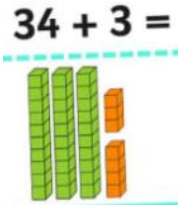
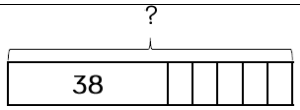
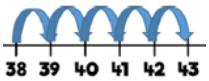
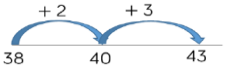
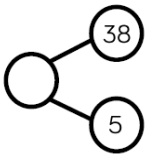
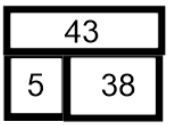
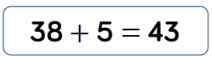
Addition

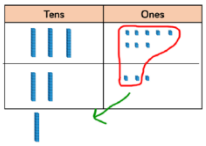
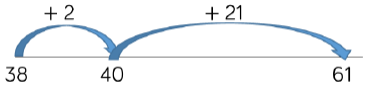
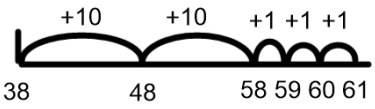
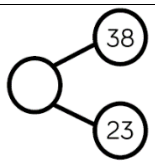
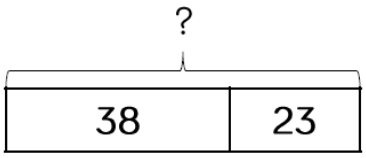


Year One Addition

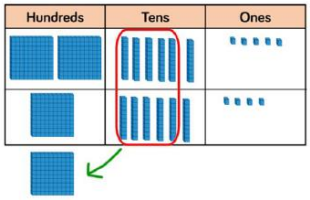
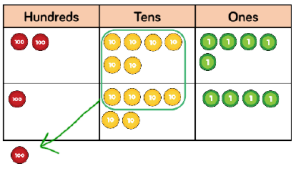
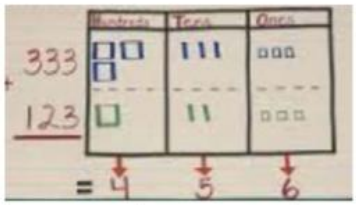
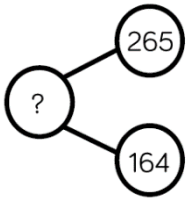
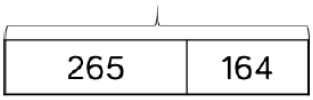
Objective	Concrete	Pictorial	Abstract
Add one digit numbers within 10	 Use counters, cubes, beadstrings and numicon to add two numbers together.	 Use pictures to add two numbers together as a part-part whole diagram or as a bar.	 Use a part part whole diagram and bar model to move into the abstract. Ensure that children understand that additions are reversible.
Add one digit and two digit numbers to 20, including 0	 Start with the larger number on a bead string and count on. Use Denes blocks to highlight the importance of ten ones equalling one ten.	 Start at the larger number on the number line and count on in ones or in one jump to find the answer. Use pictures to add numbers together as a part-part whole diagram or as a bar.	 Place the larger number in your head and count on the smaller number to find your answer. Use part part whole diagrams and bars to move into the abstract. Ensure that children understand that additions are reversible.

Year 2 Addition

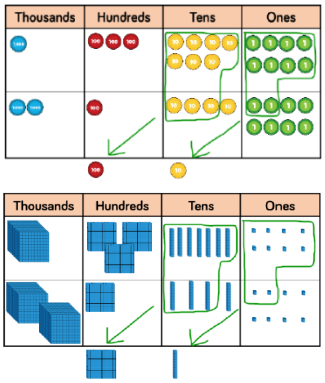
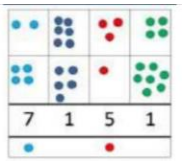
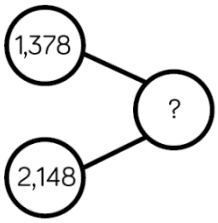
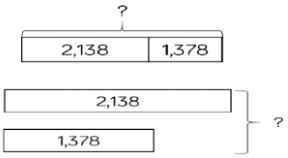
Objective	Concrete	Pictorial	Abstract
Add three 1-digit numbers	    Use numicon to encourage children to look for number bonds to 10 or doubles.	 Use part part whole diagrams and bar models to add together three groups.	    Find number bonds to 10 and add the remainder.
Add a 2 digit number and ones	  Children should be encouraged to count on from the larger number.	   Children should apply their knowledge of number bonds to add more efficiently. They should begin to use number bonds to reach the nearest 10.	   Children should be able to count on and use number lines. They should then use this information to explore related facts.

Add two 2-digit numbers to 100	 Children should begin to group ones together and may begin to exchange these for a ten when crossing tens boundaries.	  Children can use a blank numberline to count on and should be encouraged to jump on in multiples to 10 and then in ones.	 38 + 23 = 61  Children should continue to use part part whole diagrams to represent their answers.

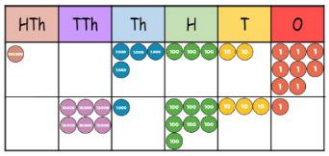
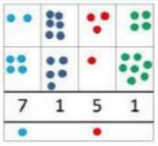
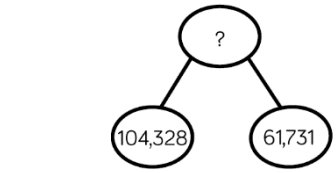
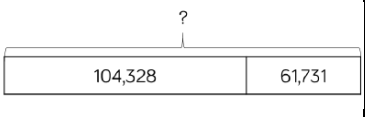
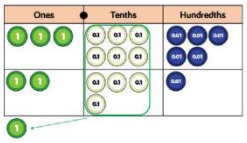
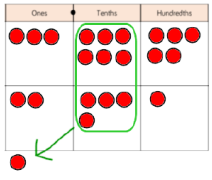
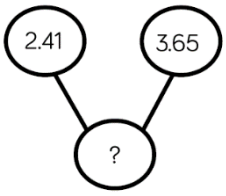
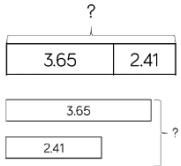
Year 3 Addition

Objective	Concrete	Pictorial	Abstract
Add numbers with up to 3 digits	  Model | Calculation Denes blocks and place value counters can be used to add 3 digit numbers and show the carrying over that happens. Children should begin to write the calculation alongside the concrete resources so they can see the links with the written column method.	 Model | Calculation Children can draw the manipulatives that they are/would be using. The calculation should be shown alongside the model to see the connection. Children should represent their calculations using bar models. Bar models should also be used to assist children in solving a variety of word problems.	 265 + 164 429 1  Children should begin to use column addition. They will become confident at carrying the tens digit to the next place value column. Children may label the columns with hundreds, tens and ones to ensure that the digits are aligned in the correct place value columns.

Year 4 addition

Objective	Concrete	Pictorial	Abstract
Add numbers with up to 4 digits	 Model | Calculation Denes blocks and place value counters can be used to add 4 digit numbers and show the carrying over that happens. Children should write the calculation alongside the concrete resources so they can see the links with the written column method.	 Model | Calculation Children can draw the manipulatives that they are/would be using. The calculation should be shown alongside the model to see the connection. Children should represent their calculations using bar models. Bar models should also be used to assist children in solving a variety of word problems.	  1 3 7 8 + 2 1 4 8 3 5 2 6 1 1 Children should be confident in using column addition including carrying tens when necessary. Children may label the columns with thousands, hundreds, tens and ones to ensure that the digits are aligned in the correct place value columns.

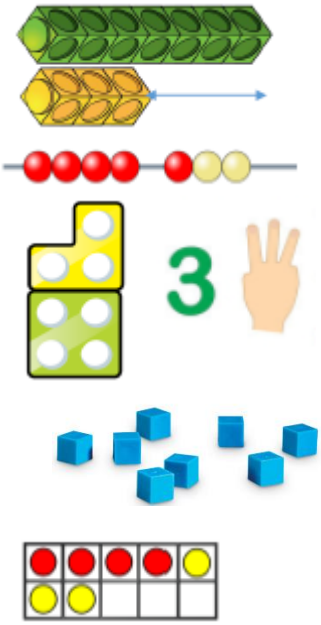
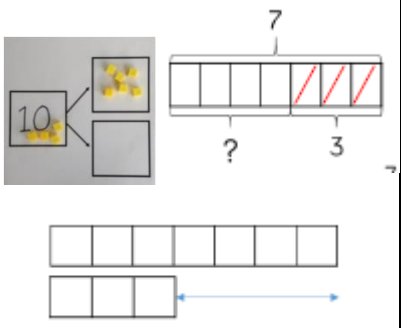
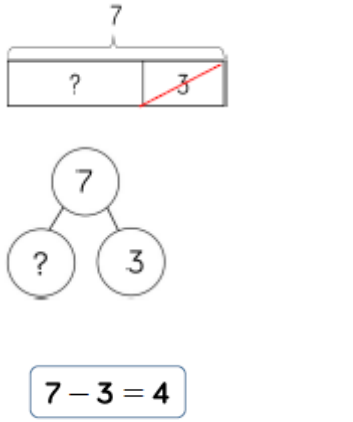
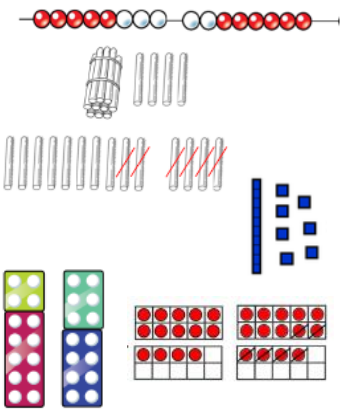
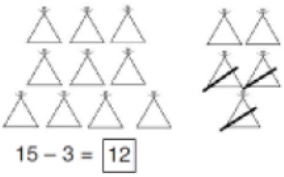
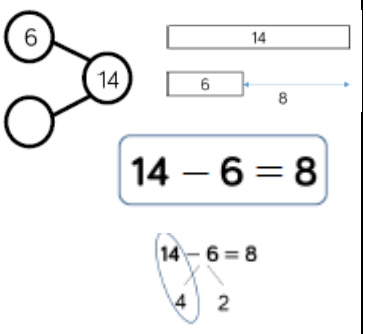
Year 5/6 Addition

Objective	Concrete	Pictorial	Abstract
Add numbers with more than 4 digits	 Model | Calculation Place value counters can be used to add numbers with more than 4 digits and show the carrying over that happens.	 Model | Calculation Children can draw the manipulatives that they are/would be using. The calculation should be shown alongside the model to see the connection. Children should represent their calculations using bar models. Bar models should also be used to assist children in solving a variety of word problems.	  1 0 4 3 2 8 + 6 1 7 3 1 1 6 6 0 5 9 1 Children should be confident in using column addition including carrying tens when necessary. Children may label the columns to ensure that the digits are aligned in the correct place value columns.
Add numbers with up to 3 decimal places	  Children may use decimal and plain counters on a place value grid to help them with carrying.	Children should represent their calculations using bar models. Bar models should also be used to assist children in solving a variety of word problems. Children should answer problems including money and measure.	  3.65 + 2.41 6.06 1 Children should use a formal method of column addition. (They may use Mrs Turner's "Santa's Belt"

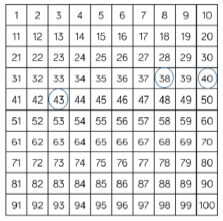
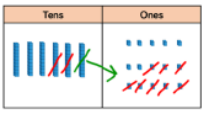
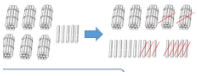
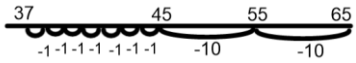
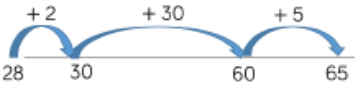
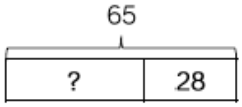
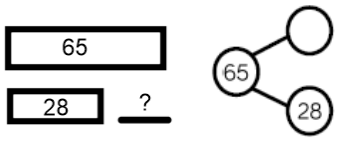
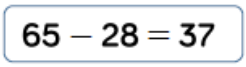
			method to ensure the digits are aligned in the correct place value columns!)

Subtraction

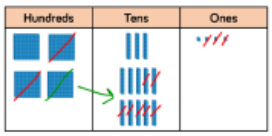
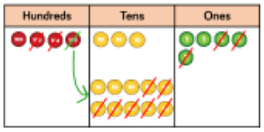
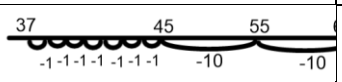
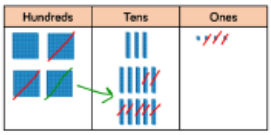
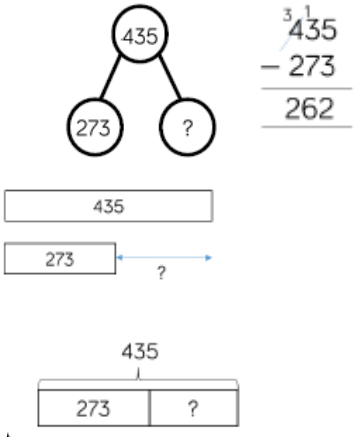
Year 1 Subtraction

Objective	Concrete	Pictorial	Abstract
Subtract one digit numbers within ten	 Children should use ten frames, denes and physical objects e.g. counters and cubes to show how objects can be subtracted.	 Children should represent their work with manipulatives through diagrams and pictures. Children may cross our drawn objects to show what has been taken away.	 Use part part whole diagrams and bar models to move subtraction into the abstract.
Add and subtract one and two digit numbers to twenty.	 When subtracting one-digit numbers that cross 10 it is important to who that ten ones is equal to ten.	 Children can cross out objects to assist in their calculations. They may also draw the manipulatives that they have been using to solve the problem in a concrete way.	 Children should be encouraged to find the number bond to ten when partitioning the subtracted number. Children should use bar bar models with one and two bars to show subtraction calculations.

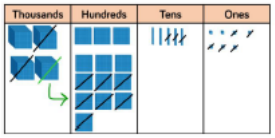
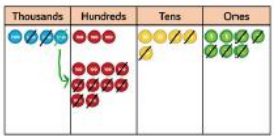
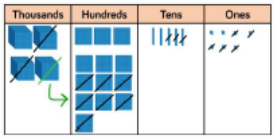
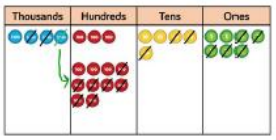
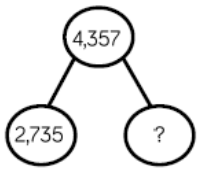
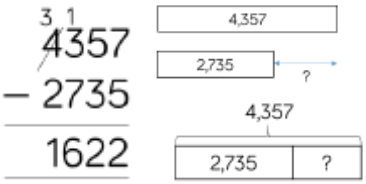
Year 2 Subtraction

Objective	Concrete	Pictorial	Abstract
Subtract 1 and 2 digit numbers to 100	    Children should use a variety of physical objects to subtract especially dienes blocks.	  Children should begin to use numberlines by counting back in tens and ones. Once confident they may count back in multiples of 10 and 5 to find their answer more efficiently. Counting on between the two numbers can also be taught once counting back has been mastered. Children may also draw the manipulatives that they have been using to solve the calculation in a concrete method.	   Children should use bar models and part part whole diagrams. Bar models should be shown using one and two bars.

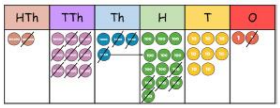
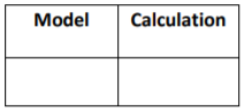
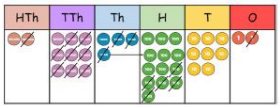
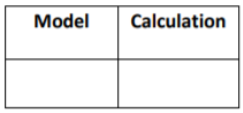
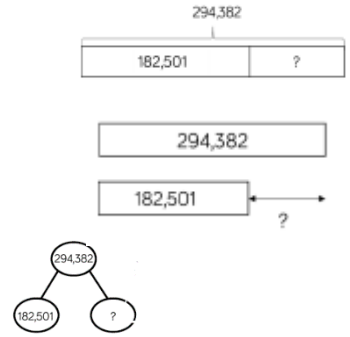
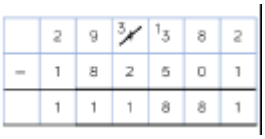
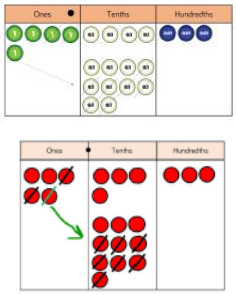
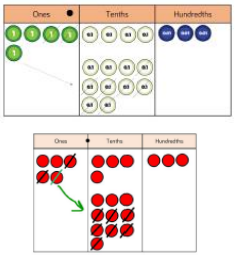
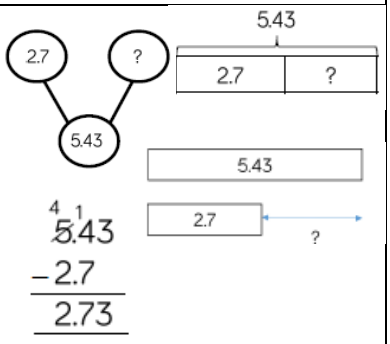
Year 3 Subtraction

Objective	Concrete	Pictorial	Abstract
Subtract numbers with up to 3 digits.	  Model | Calculation Pupils should use dienes blocks as a familiar strategy from year 2. They may also use place value counters. Using the counters and dienes is important when children begin to exchange between digits.	  Model | Calculation Pupils may begin the year continuing to use numberlines if they choose to do so. They should then begin to represent their concrete methods pictorially. Pupils should show the calculation they are carrying out next to the model.	 Pupils should continue to represent their answer using part part whole diagrams. They should also be familiar with both forms of subtraction bar models.

Year 4 Subtraction

Objective	Concrete	Pictorial	Abstract
Subtract numbers with up to 4 digits.	  Model | Calculation Pupils should continue to use dienes blocks and place value counters to physically carry out calculations. Children should have the independence to choose the strategy that they prefer. They should write the calculation they are performing next to the model.	  Model | Calculation Pupils should draw their use of manipulatives in their book to help them complete their calculations. They should have choice in the method that they are using. The calculation should be written next to the model for all questions.	  Pupils should continue to represent their answer using part part whole diagrams. They should also be familiar with both forms of subtraction bar models.

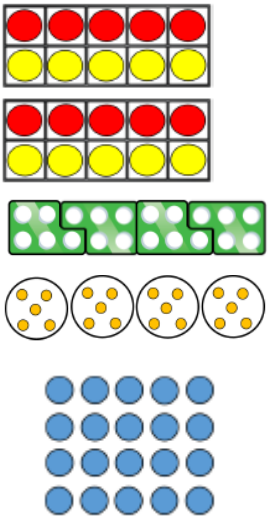
Year 5/6 Subtraction

Objective	Concrete	Pictorial	Abstract
Subtract numbers with more than 4 digits.	  Pupils should continue to use place value counters to physically carry out calculations. They should write the calculation they are performing next to the model.	  . Pupils should draw their use of manipulatives in their book to help them complete their calculations. The calculation should be written next to the model for all questions.	  Pupils should continue to represent their answer using part part whole diagrams. They should also be familiar with both forms of subtraction bar models.
Subtract with up to 3 decimal places	 Pupils should begin by using place value counters and counters to complete their calculations. They should write the calculation that they are performing next to the model.	 Pupils should draw their use of manipulatives in their book to help them complete their calculations. The calculation should be written next to the model for all questions.	 Pupils should continue to represent their answer using part part whole diagrams. They should also be familiar with both forms of subtraction bar models. Careful attention should be paid to the lining up of the decimal points.

Multiplication

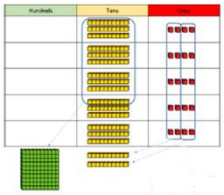
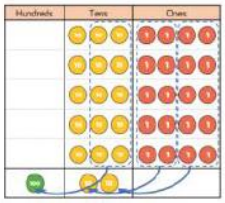
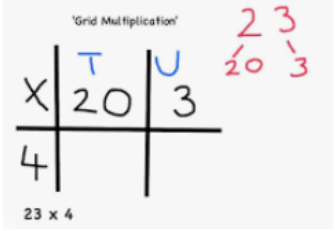
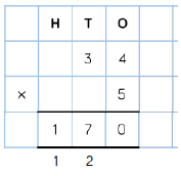
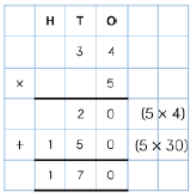
Year 1/2 Multiplication

(Pupils in year 2 are required to learn the 2, 5 and 10 times tables. They should be able to spot patterns, count forwards and backwards and make links between the times tables)

Objective	Concrete	Pictorial	Abstract
Solve 1 step problems using multiplication e.g. One bag holds 5 apples. How many apples do 4 bags hold?	 Children should have a choice of different manipulatives to solve a problem. They should be able to use counters to create arrays of the problem.	 Children may make repeated jumps on a numberline. They may also draw the manipulatives that they would use and should be able to draw arrays to help them solve a problem.	$5+5+5+5=20$ $4\times5=20$ $5\times4=20$ Children may need to carry out repeated addition or they can use their times table knowledge to solve problems.

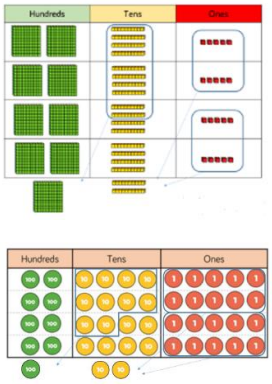
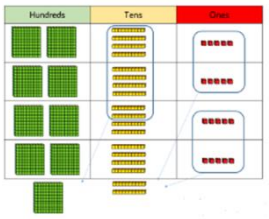
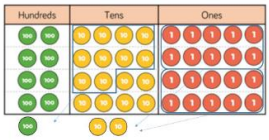
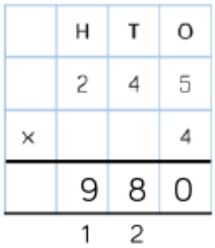
Year 3

Pupils should learn and understand their 3,4 and 8 times tables. They should be able to count in multiples, forwards and backwards and look for patterns between the times tables. They should also be able to show links between the different times tables and use arrays to show what the calculations look like.

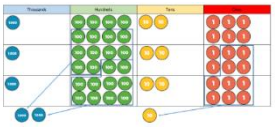
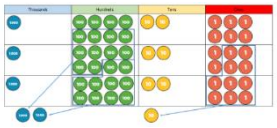
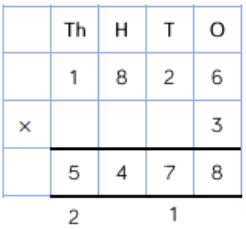
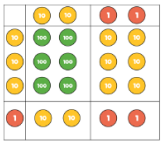
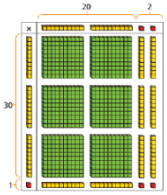
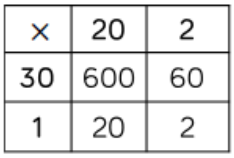
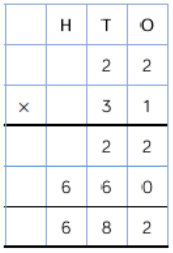
Objective	Concrete	Pictorial	Abstract
Multiply 2 digit numbers by 1 digit numbers	  Children should use a variety of manipulatives to help them multiply. They should be able to make choices about their preferred method.	 Children can draw the manipulatives they would use to solve the problem to help them. They should then move on to using the "grid method" to assist them with their multiplication. Children should draw the calculation next to the method to being to make links with the abstract concept	  Children should begin by using a grid to draw the two calculations that they are doing fully by using the expanded column menthod. They should then condense this to complete the whole calculation in one line.

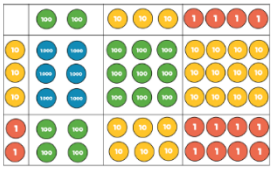
Year 4

By the end of the year children should be able to recite and understand all of the multiplications to 12 x 12. They should be able to create links between the different tables and count forwards and backwards in multiples.

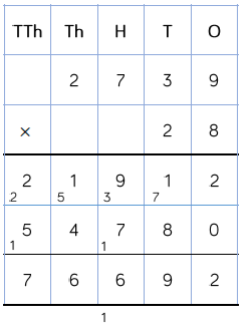
Objective	**Concrete**	**Pictorial**	**Abstract**
Multiply 3-digit numbers by 1-digit numbers	 Children should be able to use a variety of manipulatives to solve a multiplication calculation. They should be able to choose their preferred method.	  Children may draw the manipulatives that they would use. Some may also wish to use grid method to understand the concept more clearly/	 Children should be encouraged to use column multiplication. Some children may begin by using expanded column method (as in year 3) but all children should be able to use the above column method by the end of the year.

Year 5

Objective	Concrete	Pictorial	Abstract
Multiply 4-digit numbers by 1-digit numbers	 Children should use place value counters to help them complete multiplication calculations.	 Children may draw the manipulatives that they would use. Some may also wish to use grid method to understand the concept more clearly.	 Children should be encouraged to use column multiplication. Some children may begin by using expanded column method (as in year 3) but all children should be able to use the above column method by the end of the year.
Multiply 2-digit numbers by 2-digit numbers.	  Children should use dienes blocks and place value counters to solve multiplication questions. They should then be able to make choices about the method they would like to use. They should write the calcualtion next to their concrete work.	 Children may draw the manipulatives that they would have use to solve the calculatinon. They may also use grid metod to develop their understanding of the multiplciation. The calcuation should be written next to the grid method to reinforce this link.	 Children should be able to use column method by the end of year 5. Particular care should be taken to make sure that pupils are aware of common mistakes and and are able to check their answer carefully.

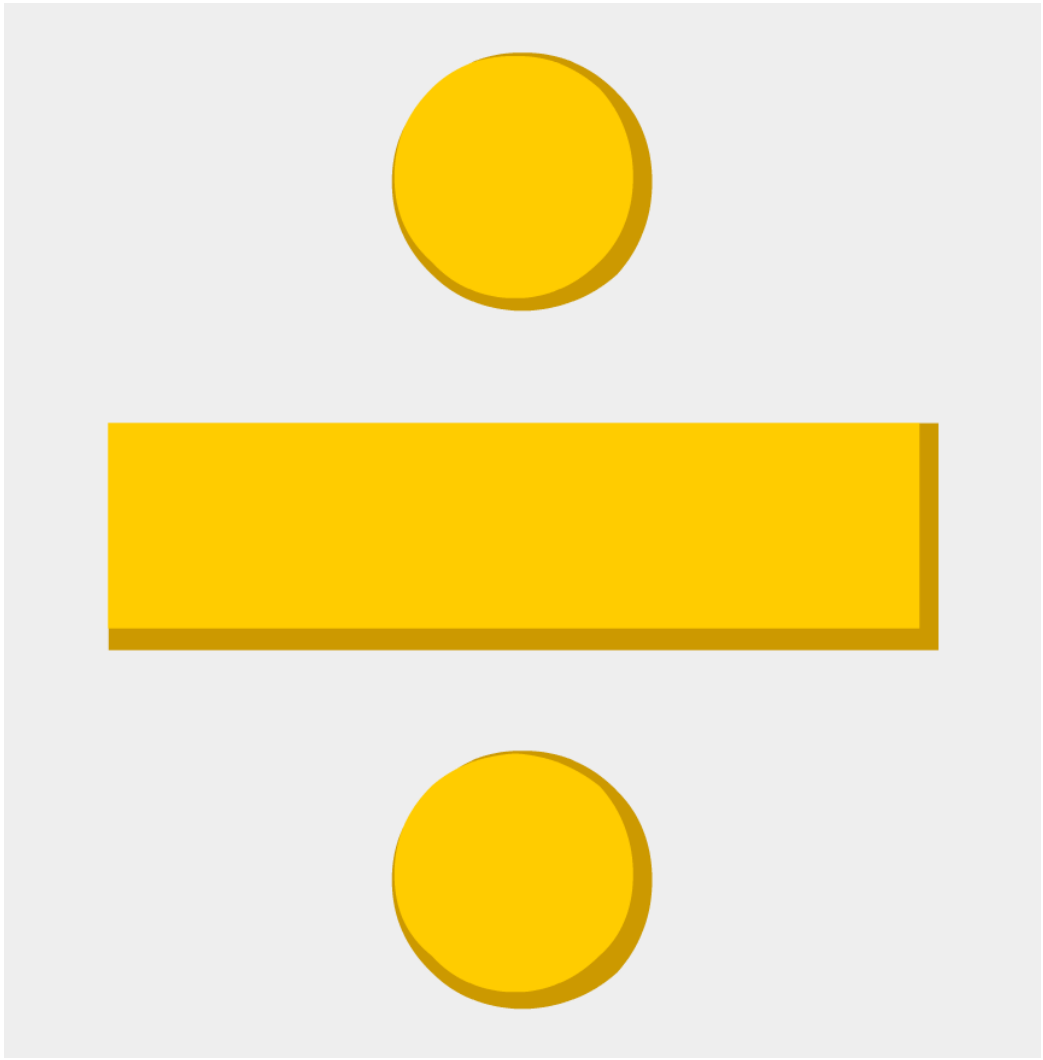
Multiply 3-digit numbers by 2-digit numbers	 Childen should use the area model to multiply 3 by 2 digit numbers. Place value counters are more efficinet to use and children should be encouraged to use these. Children should write the calculation next to the manipulativse that they have used.	<table><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> The grid method links well to the area model and can be used for children to continue to explore the method for multiplication. Children should continue to write the formal multiplication for the calculation that they have completed.	<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> By the end of year 5 pupils should be able to use column multiplcation to sovle calculations.

Year 6

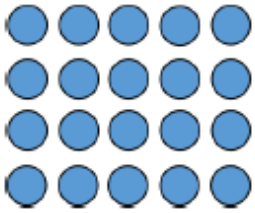
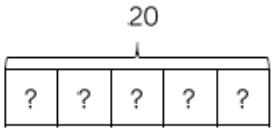
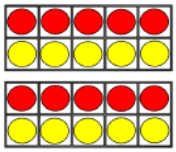
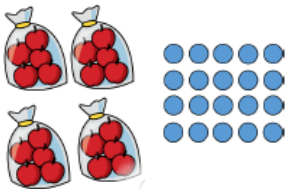
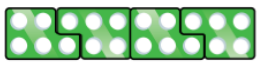
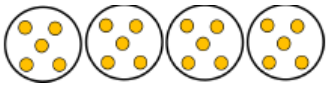
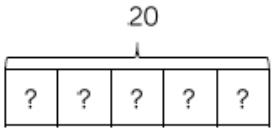
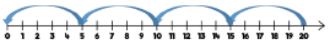
Objective	**Concrete**	**Pictorial**	**Abstract**
Multiply 4-digit numbers by 2-digit numbers.			

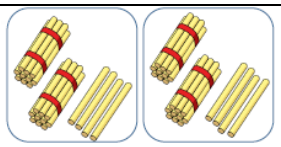
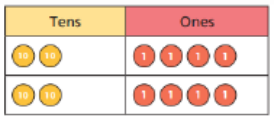
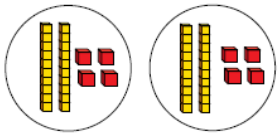
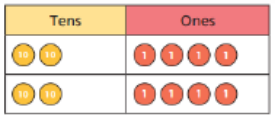
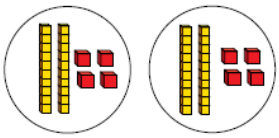
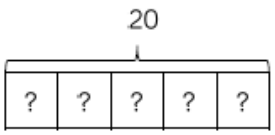
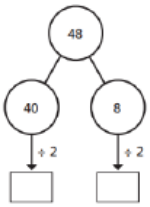
TTh	Th	H	T	O
	2	7	3	9
×			2	8
2 (2)	1 (5)	9 (3)	1 (7)	2
5 (1)	4	7 (1)	8	0
7	6	6	9	2
		(1)		

Division

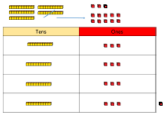
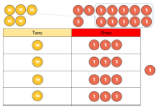
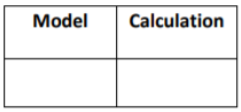
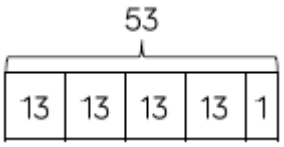
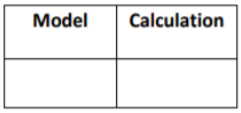


Year 1 / 2

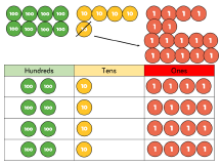
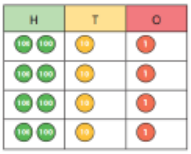
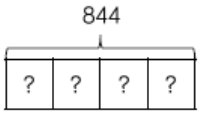
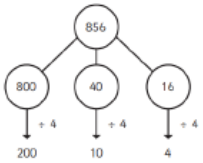
Objective	Concrete	Pictorial	Abstract
Solve 1-step problems using multiplication (sharing)	  Children can solve problems by sharing physical objects into equal groups.	  Children should be able to draw the concrete resources that they have or would use. They should also be able to use a bar model to show the sharing that they are carrying out.	$20 \div 5 = 4$ In year 1 children do not need to record a division formally but the division symbol should by introduced to children in year 2.
Solve 1 step problems using division (grouping)	   Children solve problems by grouping and counting the number of groups. Children should be encouraged to count in multiples and make links with repeated subtractions.	   Children should be able to draw the concrete resources that they have or would use. They should also be able to use a bar model to show the sharing that they are carrying out.	$20 \div 5 = 4$ In year 1 children do not need to record a division formally but the division symbol should by introduced to children in year 2.

Divide 2 digits by 1 digit (sharing with no exchange)	   When dividing larger numbers children may use manipulatives that allow them to parition into tens and ones e.g. straws, dienes blocks and place value counters. Children should try to represent their manipulations with a part part whole model.	   Children should be able to draw the manipulatives that they may use and should be able to use a bar model to help them solve problem questions involving divisions.	 Part- whole models can provide should with a clear written method that matches their concrete representaion.

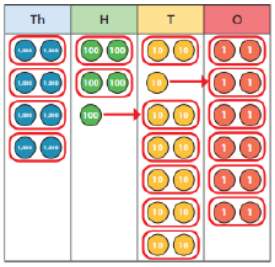
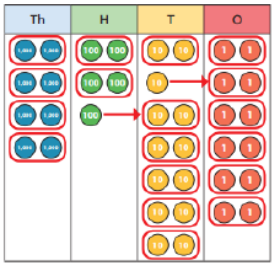
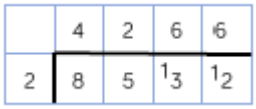
Year 3

Objective	Concrete	Pictorial	Abstract
Divide 2 digits by 1 digit (with remainders)	   When dividing numbers with remainders, children can use dienes blocks and place value counters to excahnge one ten for ten ones. Equipment outside the place value grid will highlight remainders. They should be taught how to use manipulatives for sharing and grouping.	 12÷5=2r2   Children may use numberlines to develop their skills. They may also bar model their answers or draw the manipulatives that they would use. Children should draw the model and write the calculation next to it to make links between the two.	

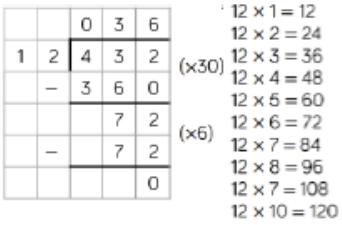
Year 4- Division

Objective	Concrete	Pictorial	Abstract
Divide 3 digits by 1 digit	  Model | Calculation   Children should be taught to use manipulatives to group and to share. Place value counters or plain counters can be used on a place value grid to support this understanding. Any models used should then have the calculation written next to them.	 844 ? ? ? ? Model | Calculation  Children can use bar models and part whole diagrams to calculate in a pictorial way. They can also draw the manipulatives that they would use.	 Children should continue to use the bus stop method that they learnt in year 3.

Year 5 division

Objective	Concrete	Pictorial	Abstract
Divide a 4 digit number by a 1 digit number.	 Model | Calculation Place value counters can be used on a place value grid to supprot children.	 Model | Calculation Children can draw the manipulative that they would use to help their understanding.	 Children should be encouraged to move away from pictorial and concrete methods when diving large numbers with multiple exchanges.

Year 6 Division

Objective	**Concrete**	**Pictorial**	**Abstract**
Divide multi digits by 2-digits	Pupils should be encouraged to use an abstract method for dividing multiple digits. They may be reminded of concrete methods when revising previously taught work.	Pupils should be encouraged to use an abstract method for this. They may be reminded of pictorial methods when revising previously taught work.	 Pupils should be taught long division. Answers may be left as remainders. Children should be reminded that this is not the same as a decimal.