

# Progression in Calculations

## Addition

Year 1 - Addition			
Objective and Strategies	Concrete	Pictorial	Abstract
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p> <p>Counting objects, partitioning and recombining sets using practical apparatus.</p> <p>Understand that the number gets bigger.</p> <p>Pictorial recording of practical experiences.</p> <p>Modelling of commutative layout. (3+6 =9, 6+3 =9)</p> <p>Counting on from the larger number.</p>	<p>Basic to subject specific (Beck's Tiers): +, add, more, plus, make, sum, total, altogether, score double, near double one more, two more... ten more how many more to make...? how many more is... than...? how much more is...?</p> <p>Instructional vocabulary: start from, start with, start at, look at, point to, show me</p> <p>Use cubes to add two numbers together as a group or in a bar.</p> $8 + 1 = 9$	<p>Use pictures to add two numbers together as a group or in a bar.</p> $8 + 1 = 9$	$4 + 3 = 7$ $10 = 6 + 4$ <p>Use the part-part whole diagram as shown above to move into the abstract.</p>



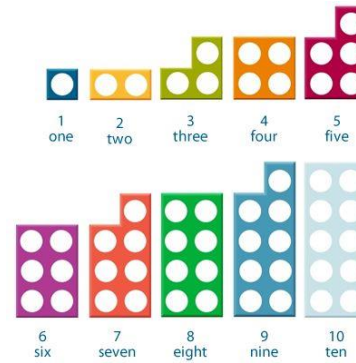
$1 + 1 = 2$   
double 1 is 2

$2 - 1 = 1$   
half of 2 is 1



$2 + 2 = 4$   
double 2 is 4

$4 - 2 = 2$   
half of 4 is 2



Recognition of quantities. Find the larger number first.

$$\begin{array}{r} \textcircled{4} + \textcircled{7} + \textcircled{6} = \boxed{10} + \boxed{7} \\ 10 \\ = \boxed{17} \end{array}$$

Look for number bonds (as above)

$5 + 8$  is re-ordered to  $8 + 5$ .

Count on from 8.

Therefore,  $8 + 5 = 13$

**Year 2 - Addition**

Layers of vocabulary



Beck's Tiers of Vocabulary

**Basic to subject specific (Beck's Tiers):**

+, add, addition, more, plus make, sum, total altogether score double, near double one more, two more... ten more... one hundred more how many more to make...? how many more is... than...? how much more is...?

**Instructional vocabulary:**

tell me, describe, name, pick out, discuss, talk about, explain, explain your method, explain how you got your answer, give an example of... show how you...

**Objective and Strategies**

**Concrete**

**Pictorial**

**Abstract**

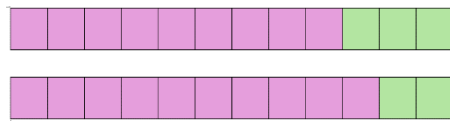
Key skills of knowing number bonds to 10 and within 20.

Regrouping to make bonds to 10.

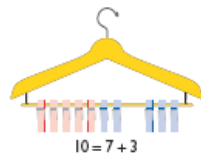
Develop knowledge of fact families, e.g. 2, 5, 7.

All answers to be recorded in a number sentence following any informal recording.

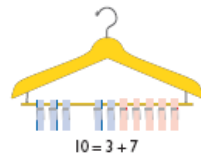
Understand the effect of adding a zero.



This shows regrouping of 9 + 3 to become 10 + 2.

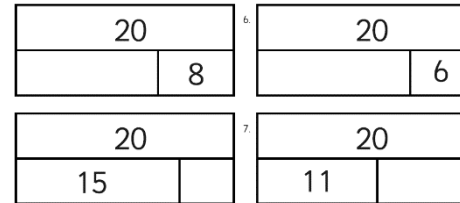


10 = 7 + 3

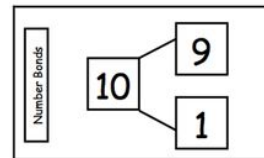


10 = 3 + 7

This shows the fact family of 10, 7 and 3.



Use pictorial representations. Regroup or partition the smaller number to make 10.



**Fact families.**  
 9+1=10  
 1+9=10  
  
 100 = 80 + 20  
 100 = 20 + 80

7 + 4 = 11

If I am at seven, how many more do I need to make 10?

7 + 8 = 15

15 = 8 + 7

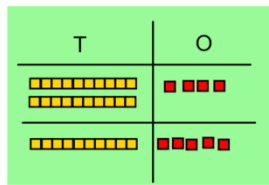
If I add zero to any number, the number stays the same.

16 + 0 = 16

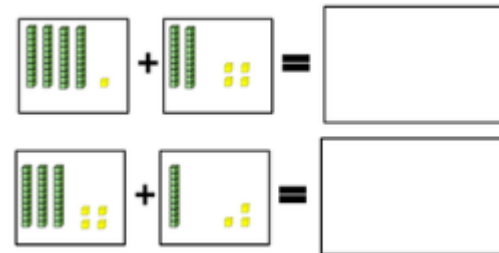
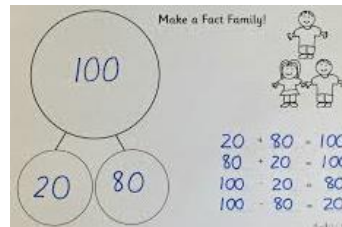
Add a 2 digit number and units.

Add a 2 digit number and tens.

Add two 2 digit numbers.



Build the 2 digit numbers using base 10.



Pupils to record their own 'sticks and dots'

$$34 + 23 = 57$$

$$30 + 20 = 50$$

$$4 + 3 = 7$$

34 + 19 is the same as 33 + 20.

Summer term of Year 2, if pupils are secure – bridge 100.

Year 3 - Addition

Layers of vocabulary



Beck's Tiers of Vocabulary

**Basic to subject specific (Beck's Tiers):**

+, add, addition, more, plus, make, sum, total, altogether, score, double, near double, one more, two more... ten more... one hundred more, how many more to make...? how many more is... than...? how much more is...?

**Instructional vocabulary:**

explain your method, explain how you got your answer, give an example of... show how you... show your working

Objective and Strategies

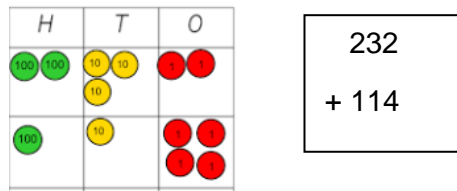
Introduce column addition without crossing the boundary

$$\begin{array}{r} 24 \\ +53 \\ \hline 77 \end{array} \quad \begin{array}{l} (20+4) \\ (50+3) \\ (70+7) \end{array}$$

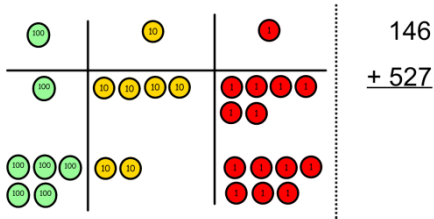
Know the complements to 100. (For example  $60 + 40 = 100$  AND  $63 + 37 = 100$ ).

Introduce column addition with crossing the boundary

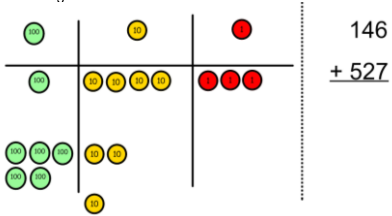
Concrete



Make both numbers on a place value grid (not crossing boundary)

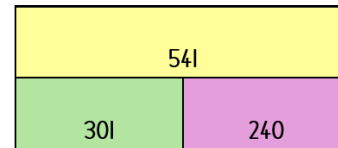


Add up the units and exchange 10 ones for one 10 (crossing boundary)



Pictorial

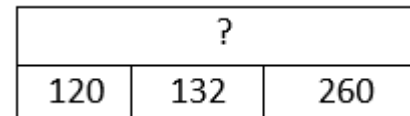
After practically using the base 10 and/or and place value counters, children can use bar models to represent the addition.



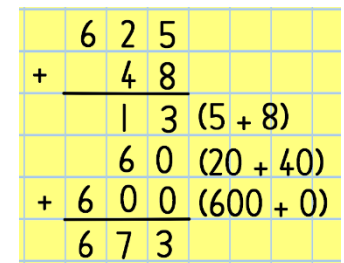
$$\square + \square = \square$$

$$\square + \square = \square$$

Understand that the total is the result when adding the parts together.



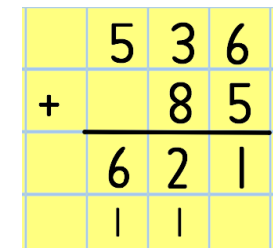
Abstract



Expanded method first

Then, use compact method without crossing a boundary.


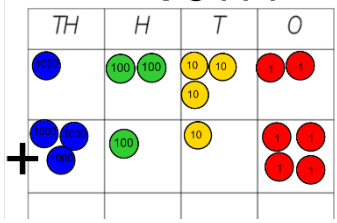
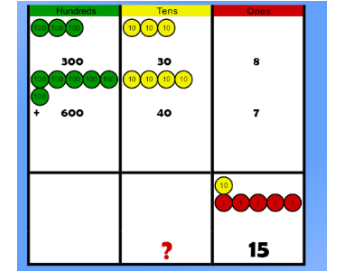

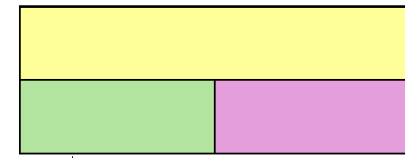
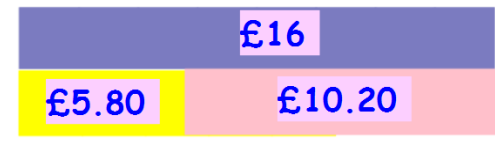
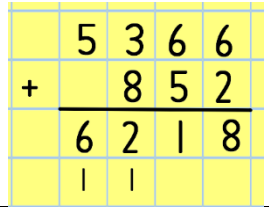
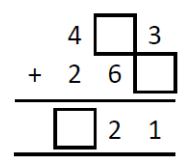
Then, compact with crossing a boundary to carry digits:



## St Bartholomew's MAT Calculation Policy



	<p>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.</p> <p>This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.</p>		
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Year 4 – Addition									
<p>Layers of vocabulary</p>  <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b> add, addition, more, plus, increase, sum, total, altogether score double, near double how many more to make...?</p> <p><b>Instructional vocabulary:</b> calculate, work out, solve, investigate, question, answer, check</p>								
Objective and Strategies	Concrete	Pictorial	Abstract						
<p>Begin to use column addition without crossing the boundary using 4 digit numbers.</p> <p>Begin to use column addition with crossing the boundary with 4 digit numbers.</p> <p>Use column addition in the contexts of measures to include decimals.</p>	<p><b>1232 + 3114</b></p>   <p>Crossing a boundary.</p>	<p>After practically using the place value counters and/or base ten, children can use bar models to represent the addition.</p> <p><math>6509 + 2170 =</math></p>  <p><math>1890 + 362 =</math></p>  	<p>Column addition:</p>  <p>Once confident with the method, analytical opportunities should be offered.</p> <table border="1" data-bbox="1590 989 2105 1133"> <thead> <tr> <th>Calculation</th> <th>Error</th> <th>Correct solution</th> </tr> </thead> <tbody> <tr> <td> <math display="block">\begin{array}{r} 1482 \\ + 672 \\ \hline 8202 \end{array}</math> </td> <td></td> <td></td> </tr> </tbody> </table> <p>Find the missing numbers in these calculations.</p> 	Calculation	Error	Correct solution	$\begin{array}{r} 1482 \\ + 672 \\ \hline 8202 \end{array}$		
Calculation	Error	Correct solution							
$\begin{array}{r} 1482 \\ + 672 \\ \hline 8202 \end{array}$									

# St Bartholomew's MAT Calculation Policy




	Year 5	Year 6
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      add, addition, more, plus, increase sum, total, altogether score double, near double how many more to make...?</p> <p><b>Instructional vocabulary:</b>                      put, place arrange, rearrange change, change over split, separate</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      add, addition, more, plus, increase sum, total, altogether score double, near double how many more to make...?</p> <p><b>Instructional vocabulary:</b>                      put, place arrange, rearrange change, change over adjusting, adjust split, separate, carry on, continue, repeat what comes next? predict describe the pattern, describe the rule, find, find all, find different investigate</p>





Subtraction

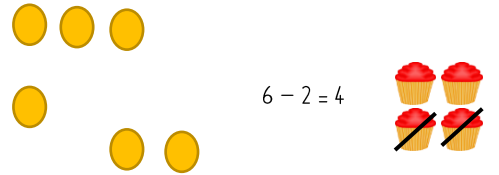
Year 1 - Subtraction			
<p>Layers of vocabulary</p>  <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b> take away, distance between, difference between, less than. How many more? How much greater? How many fewer?</p>	<p>how much more is...? — subtract, take (away), minus, leave, how many are left/left over? how many have gone? one less, two less, ten less... how many fewer is... than...? how much less is...? difference between, = equals, sign, is the same as <b>Instructional vocabulary:</b> start from, start with, start at, look at point, to show me</p>	
<p>Objective and Strategies</p>	<p>Concrete</p>	<p>Pictorial</p>	<p>Abstract</p>

Know that the number gets smaller because objects have been removed from the set.

Practical models of subtraction.

Concept of take away and counting back.

Use physical objects, counters, cubes etc to show how objects can be taken away.

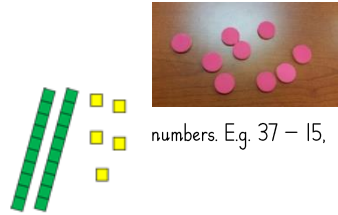


Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.



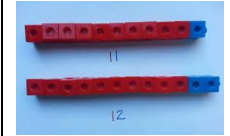
13 - 4

Use counters and move them away from the group as you take them away counting backwards as you go.



Use dienes to subtract larger numbers. E.g. 37 - 18

Compare amounts and objects to find the difference.

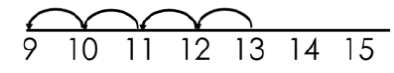
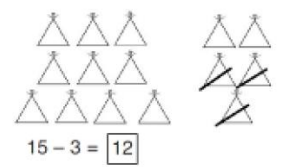


Use cubes to build towers or make bars to find the difference

Concept of find the difference as counting on.

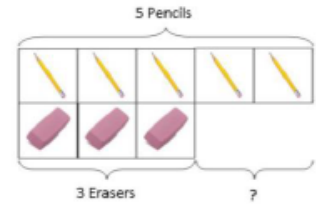
Cross out drawn objects to show what has been taken away.

Count back on a number line or number track



Start at the bigger number and count back the smaller number showing the jumps on the number line.

Use basic bar models with items to find the difference



18 - 3 = 15

8 - 2 = 6

Put 13 in your head, count back 4. What number are you at? Use your fingers to help.

Tom has 5 pencils. Emma has pencils. How many more pencils does Tom have?

**Year 2 - Subtraction**

Layers of vocabulary



Beck's Tiers of Vocabulary

**Basic to subject specific (Beck's Tiers):**

subtract, subtraction, take (away), minus leave, how many are left/left over? one less, two less... ten less... one hundred less how many fewer is... than...? how much less is...?  
 difference between half, halve = equals, sign, is the same as, tens boundary  
 difference, partition, rearrange, inverse, place value

**Instructional vocabulary:**

tell me, describe, name, pick out, discuss, talk about, explain, explain your method, explain how you got your answer, give an example of... show how you...

**Objective and Strategies**

**Concrete**

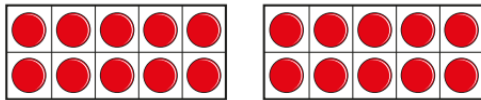
**Pictorial**

**Abstract**

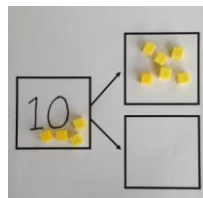
Deepening understanding of take away and find the difference as strategies for subtraction.

Understand the effect of zero in subtraction.

Know that subtraction is the inverse of addition



Use ten frames to subtract. E.g.  $20 - 4$



Link to addition.

$$10 = 6 + 4$$

$$10 - 6 = 4$$

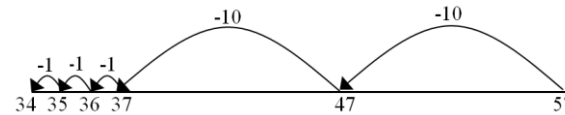
Use patterns to find answers to subtractions

$$10 + 4 =$$

$$10 - 4 =$$

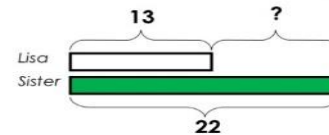
$$20 + 4 =$$

$$20 - 4 =$$



**Comparison Bar Models**

Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.



$57 - 23 = 34$  (children could draw own 'sticks and dots' to support)

**Partitioning the second number strategy**

$$76 - \underline{43} =$$

$$76 - 40 = 36$$

$$36 - 3 = 33$$

When it is a subtraction calculation, underline the second number – this is the only number that can be partitioned.

$$73 - 46 =$$

$$73 - 40 = 33$$

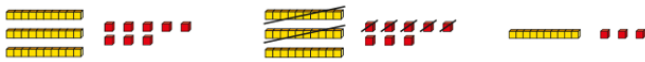
$$33 - 6 = 27$$

What is the difference between 18 and 26?

Increasing knowledge of fact families.

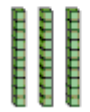

2 digit subtract 2 digit.

Build with base 10. Remove the base 10, or cross them out if doing it pictorially.



$$\square - \square = \square$$

**Think:**  
I have 3 tens and 4 ones. I want to take away 9 ones.

Workmat	
Tens	Ones
	

Find the difference  
Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.

**Year 3 - Subtraction**

Layers of vocabulary



Beck's Tiers of Vocabulary

**Basic to subject specific (Beck's Tiers):**

subtract, subtraction, take (away), minus, leave, how many are left/left over? one less, two less... ten less... one hundred less how many fewer is... than...? how much less is...? difference between half, halve = equals, sign, is the same as, tens boundary, hundreds boundary, exchange, carried digits

**Instructional vocabulary:**

explain your method, explain how you got your answer, give an example of... show how you... show your working

Objective and Strategies

Concrete

Pictorial

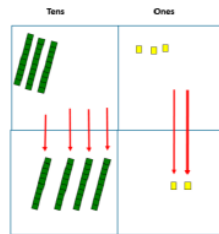
Abstract

Column method without exchange.

Column method with exchange.

HTU – HTU

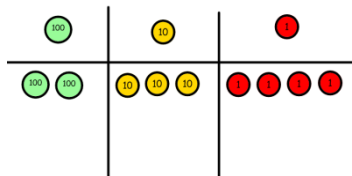
The concept of zero as a place holder e.g. 406 has 6 units/ones and 40 tens which is the same as four hundred.



Use Base 10 to make the bigger number then take the smaller number away.

Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

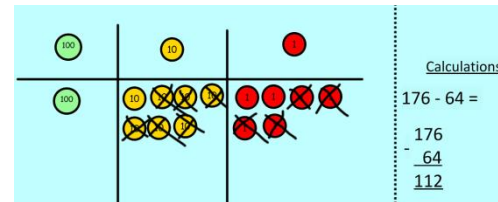
Make the larger number with the place value counters



Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$$

Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



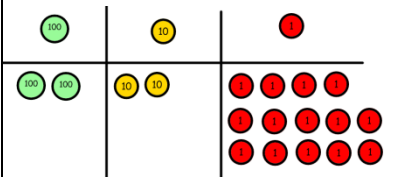
	368
124	?

	H	T	O
	3	5	8
-	2	2	6

Column subtraction; no exchange

	H	T	O
	4	4	4
-	2	2	6

Column subtraction; with exchange

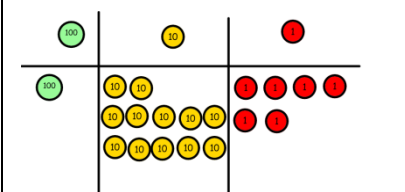


Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$$

Now I can subtract my ones.  
Now look at the tens, can I take away 8 tens easily? I need to exchange one

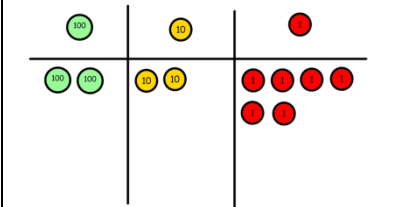
hundred for ten tens.



Calculations

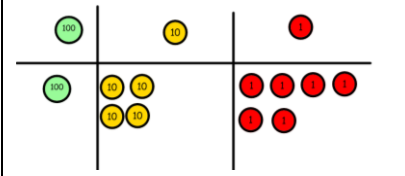
$$\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$$

Now I can take away eight tens and complete my subtraction



Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline \end{array}$$



Calculations

$$\begin{array}{r} 234 \\ - 88 \\ \hline 146 \end{array}$$

Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.

# St Bartholomew's MAT Calculation Policy



Year 4 - Subtraction																																																																
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      subtract, subtraction, take (away), minus, decrease, leave, how many are left/left over? difference between, half, halve, how many more/less is... than...? how much more/less is...? equals, sign, is the same as, tens boundary, hundreds boundary, inverse, exchange, carried digits</p> <p><b>Instructional vocabulary:</b>                      calculate, work out, solve, investigate, question, answer, check</p>																																																															
<p>Objective and Strategies</p>	<p>Concrete</p>	<p>Pictorial</p>	<p>Abstract</p> <p>This will lead to an understanding of subtracting any number including decimals.</p>																																																													
<p>Column method without exchange.</p> <p>Column method with exchange.</p> <p>4 digit subtract 4 digit.</p> <p>Apply method in the context of measures, including decimals.</p> <p>Continue the concept of zero as a place holder e.g. 5026 has 6 units/ones and 50 hundreds which is the same as five thousand.</p>	<p>Use place value chart and counters to build numbers and cross out to subtract the smaller number.</p> <p>Use the place value chart to work out <math>5,624 - 2,301</math></p> <table border="1" data-bbox="376 758 929 965"> <thead> <tr> <th>Th</th> <th>H</th> <th>T</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>1,000 1,000</td> <td>100 100</td> <td>10 10</td> <td>1 1</td> </tr> <tr> <td>1,000 1,000</td> <td>100 100</td> <td></td> <td>1 1</td> </tr> <tr> <td>1,000</td> <td>100 100</td> <td></td> <td></td> </tr> </tbody> </table> <p><math>5,624 - 2,301 = \square</math></p>		Th	H	T	O	1,000 1,000	100 100	10 10	1 1	1,000 1,000	100 100		1 1	1,000	100 100			<p>Bar modelling.</p> <table border="1" data-bbox="1120 762 1527 877"> <tr> <td colspan="2">3682</td> </tr> <tr> <td>1245</td> <td>?</td> </tr> </table>	3682		1245	?	<p>Compact method: no exchange</p> <p>Complete the calculation.</p> <table border="1" data-bbox="1751 785 2105 1031"> <thead> <tr> <th></th> <th>Th</th> <th>H</th> <th>T</th> <th>O</th> </tr> </thead> <tbody> <tr> <td></td> <td>5</td> <td>6</td> <td>2</td> <td>4</td> </tr> <tr> <td>-</td> <td>2</td> <td>3</td> <td>0</td> <td>1</td> </tr> <tr> <td colspan="5"><hr/></td> </tr> </tbody> </table> <p>With exchange:</p> <table border="1" data-bbox="1751 1177 2074 1433"> <thead> <tr> <th></th> <th>Th</th> <th>H</th> <th>T</th> <th>O</th> </tr> </thead> <tbody> <tr> <td></td> <td>7</td> <td>3</td> <td>2</td> <td>5</td> </tr> <tr> <td>-</td> <td>2</td> <td>4</td> <td>0</td> <td>6</td> </tr> <tr> <td colspan="5"><hr/></td> </tr> </tbody> </table>		Th	H	T	O		5	6	2	4	-	2	3	0	1	<hr/>						Th	H	T	O		7	3	2	5	-	2	4	0	6	<hr/>				
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# St Bartholomew's MAT Calculation Policy




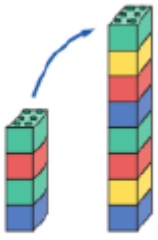

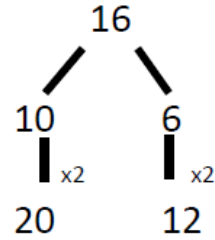
Look at the accurate exchanging with more than one zero:

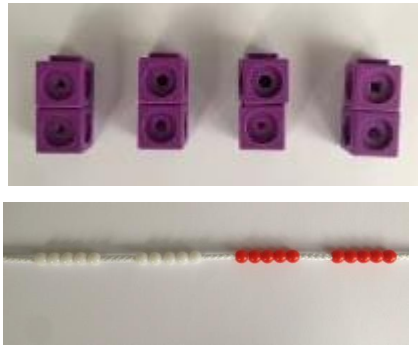
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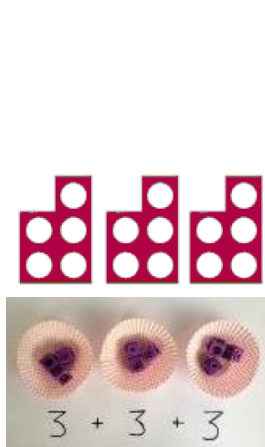
	Year 5	Year 6
<p>Layers of vocabulary</p>  <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      subtract, subtraction, take (away), minus, leave, how many are left/left over? ten less... one hundred less how many fewer is... than...? how much less is...? difference between half, halve = equals, sign, is the same as tens boundary, hundreds boundary, inverse, units boundary, tenths boundary, exchange, carried digits</p> <p><b>Instructional vocabulary:</b>                      put, place, arrange, rearrange change, change over, adjusting, adjust, split, separate</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      subtract, subtraction, take (away), minus, decrease leave, how many are left/left over? difference between half, halve how many more/fewer is... than...? how much more/less is...? equals, sign, is the same as tens boundary, hundreds boundary, units boundary, tenths boundary, inverse</p> <p><b>Instructional vocabulary:</b>                      put, place arrange, rearrange change, change over adjusting, adjust split, separate, carry on, continue, repeat, what comes next? Predict, describe the pattern, describe the rule, find, find all, find different, investigate</p>

# Multiplication

Year 1 - Multiplication			
<p>Layers of vocabulary</p>  <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      count in ones, twos... tens...                      array, groups of, equal groups, odd, even</p> <p><b>Instructional vocabulary:</b>                      carry on, continue repeat what comes next?                      find, choose, collect, use, make, build                      tell me, describe, pick out, talk about, explain, show me,                      read, write, record</p>		
<p>Objective and Strategies</p>	<p>Concrete</p>	<p>Pictorial</p>	<p>Abstract</p>
<p>To understand the concept of doubling.</p> <p>Counting in steps of 2s, 5s, 10s.</p> <p>To understand that multiplication is repeated addition.</p>	<p>Use practical activities to show how to double a number.</p> <p>Draw pictures to show how to double a number.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div data-bbox="465 885 622 1193" style="text-align: center;">  <p>double 4 is 8 <math>4 \times 2 = 8</math></p> </div> <div data-bbox="1097 949 1601 1193" style="text-align: center;"> <p>Double 4 is 8</p>  </div> <div data-bbox="1836 869 2049 1109" style="text-align: center;">  </div> </div> <p>Partition a number and then double each part before recombining it back together.</p>		

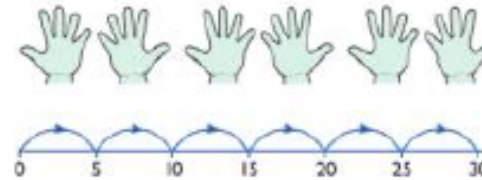


Count in multiples supported by concrete objects in equal groups.



Use different objects to add equal groups.

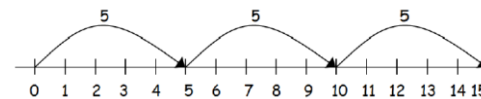
Use a number line or pictures to continue support in counting in multiples.



There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?



2 add 2 add 2 equals 6



$5 + 5 + 5 = 15$

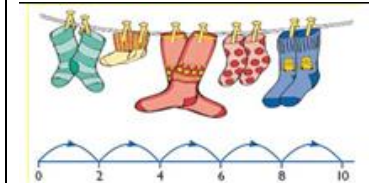
Count in multiples of a number aloud.

Write sequences with multiples of numbers.

2, 4, 6, 8, 10

5, 10, 15, 20, 25, 30

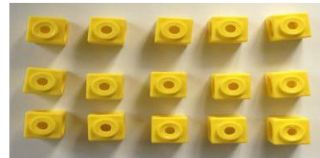
Write addition sentences to describe objects and pictures.



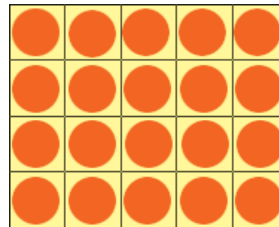
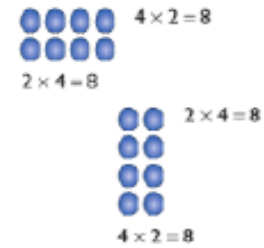
$2 + 2 + 2 + 2 + 2 = 10$   
 $2 \times 5 = 10$   
 2 multiplied by 5  
 5 pairs  
 5 hops of 2

To use arrays to show that multiplication is commutative.

Create arrays using counters/ cubes to show multiplication sentences.



Draw arrays in different rotations to find **commutative** multiplication sentences.



Link arrays to area of rectangles.

Use an array to write multiplication sentences and reinforce repeated addition.



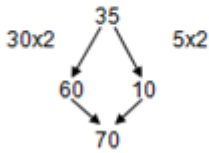


$$5 + 5 + 5 = 15$$

$$3 + 3 + 3 + 3 + 3 = 15$$

$$5 \times 3 = 15$$

$$3 \times 5 = 15$$

Year 2 - Multiplication									
<p>Layers of vocabulary</p>  <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b> lots of, groups of <math>\times</math>, times, multiply, multiplied by multiple of once, twice, three times... ten times... times as (big, long, wide... and so on) repeated addition array row, column double, halve share, share equally</p> <p><b>Instructional vocabulary:</b> carry on, continue, repeat, what comes next? predict describe the pattern describe the rule find, find all, find different, investigate</p>								
Objective and Strategies	Concrete	Pictorial	Abstract						
<p>Know tables facts for 2s, 10s and 5s and begin 3s and 4s.</p> <p>To be able to partition a 2 digit number. E.g. 12 x 5 is...</p> <p>10 x 5 Add 2 x 5</p> <p>Doubles are the same as multiplying by 2.</p>	<p>Use counters, pegs boards, money to build arrays.</p>	<p>Consolidate arrays and repeated addition. Recalling facts. <math>4 \times 5 = 20, 5 \times 4 = 20.</math></p>  <table border="1" data-bbox="972 1046 1715 1165"> <tr> <td colspan="3" style="text-align: center;">12</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">4</td> <td style="text-align: center;">4</td> </tr> </table>	12			4	4	4	<p>Partitioning strategy for doubling. Double 35</p>  <p>Know that <math>3 \times 4</math> is that same as <math>4 + 4 + 4</math></p>
12									
4	4	4							

**Year 3 - Multiplication**

Layers of vocabulary



Beck's Tiers of Vocabulary

**Basic to subject specific (Beck's Tiers):**

lots of, groups of  $\times$ , times, multiply, multiplication, multiplied by multiple of, product once, twice, three times... ten times... times as (big, long, wide... and so on) repeated addition array row, column double, halve share, share equally one each, two each, three each...

**Instructional vocabulary:**

carry on, continue, repeat what comes next? Predict, describe the pattern, describe the rule, find, find all, find different, investigate, choose, decide, collect

**Objective and Strategies**

**Concrete**

**Pictorial**

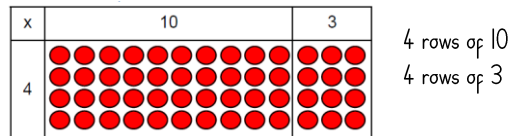
**Abstract**

Know times tables for: 2, 3, 4, 5, 8, 10.

Understand multiplying by 10.

Understand that multiplying a number by zero, the answer will always be zero.

Show the link with arrays to introduce partitioning for multiplication.



Move on to using Base 10/dienes to move towards a more compact method.



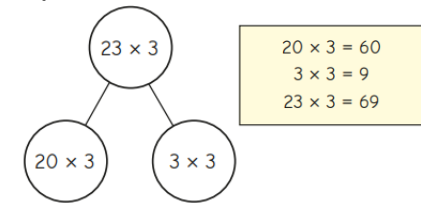
$30 \times 2 = 60$   
 $2 \times 2 = 4$

$60 + 4 = 64$   
 $32 \times 2 = 64$

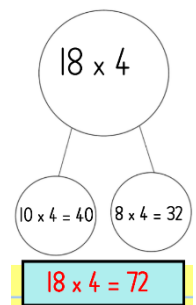
Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking.

Multiply a 2 digit number by a one digit number (no exchange)



Multiply a 2 digit number by a one digit number (with exchange)



Multiplication with expanded method:

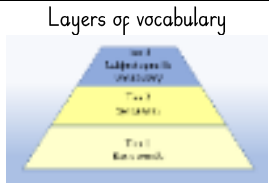


# St Bartholomew's MAT Calculation Policy





**Year 4 - Multiplication**



Beck's Tiers of Vocabulary

**Basic to subject specific (Beck's Tiers):**

lots of, groups of times, multiply, multiplication, multiplied by multiple of, product once, twice, three times... ten times... times as (big, long, wide... and so on) repeated addition array row, column double, halve, factor, multiple

**Instructional vocabulary:**

carry on, continue, repeat what comes next? predict, describe the pattern, describe the rule pattern, puzzle, calculate, calculation, mental calculation, method, jotting, answer right, correct, wrong, what could we try next? how did you work it out? number sentence, sign, operation, symbol, equation

**Objective and Strategies**

**Concrete**

**Pictorial**

**Abstract**

To know all multiplication facts up to 12 x 12.

To know how to multiply by 10 and 100.

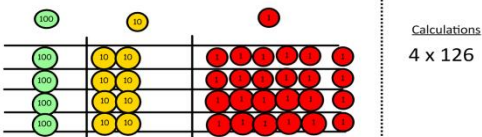
To understand distributive law.

Begin to use short multiplication method (short is when there is a single multiplier).

Fill each row with 126.  
Move on to place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows.



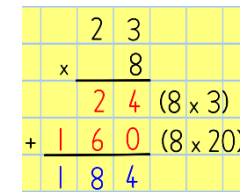
Add up each column, starting with the ones making any exchanges needed.



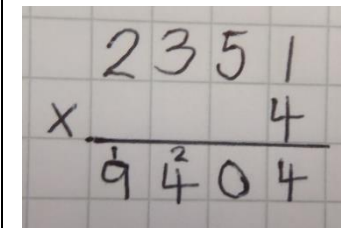
Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking.



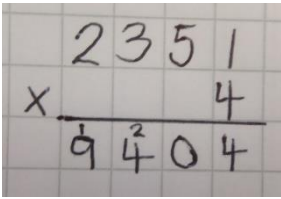
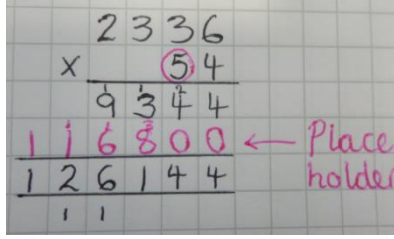
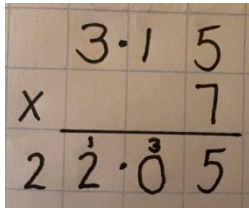
Start with expanded short multiplication, reminding the children about lining up their numbers clearly in columns.




Once confident, move to compact notation:



**Year 5 – Multiplication**

<p>Layers of vocabulary</p>  <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b> lots of, groups of times, multiply, multiplication, multiplied by, multiple of, product, once, twice, three times... ten times... times as (big, long, wide... and so on) repeated addition array, row, column, double, halve, share, share equally, factor, multiple, prime, composite</p> <p><b>Instructional vocabulary:</b> carry on, continue, repeat what comes next?, predict, describe the pattern, describe the rule, find, find all, find different, investigate</p>																				
<p><b>Objective and Strategies</b></p>	<p><b>Concrete</b></p>	<p><b>Pictorial</b></p>	<p><b>Abstract</b></p>																		
<p>To know all multiplication facts up to 12 x 12.</p> <p>To know how to multiply by 10, 100 and 1000.</p> <p>Begin to use long multiplication method (short is when there is a single multiplier).</p> <p>Move to working with decimals.</p> <p>multiply numbers with up to two decimal places by whole numbers (year 6)</p>	<p>Understanding the effect of multiplying by 10, 100 and 1000. Create a visual place value chart and model numbers physically moving when multiplying/dividing by multiples of 10.</p> 	<p>Moving forward, multiply by a 2 digit number showing the different rows within the calculation</p> <p>Use a laminated place value resource to assist children in multiplying/dividing by multiples of 10.</p> <p><b>Multiplying and Dividing by 10, 100 and 1000</b></p> <table border="1" data-bbox="996 1037 1579 1189"> <tr> <td>10 000</td> <td>1000</td> <td>100</td> <td>10</td> <td>1</td> <td>•</td> <td><math>\frac{1}{10}</math></td> <td><math>\frac{1}{100}</math></td> <td><math>\frac{1}{1000}</math></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td>•</td> <td></td> <td></td> <td></td> </tr> </table> <div style="display: flex; justify-content: space-around;"> <div data-bbox="996 1204 1288 1348"> <p><b>Multiplying</b></p> <p>X 10    digits move LEFT 1 space X 100    digits move LEFT 2 spaces X 1000    digits move LEFT 3 spaces</p> <p>←</p> </div> <div data-bbox="1288 1204 1579 1348"> <p><b>Dividing</b></p> <p>÷ 10    digits move RIGHT 1 space ÷ 100    digits move RIGHT 2 spaces ÷ 1000    digits move RIGHT 3 spaces</p> <p>→</p> </div> </div>	10 000	1000	100	10	1	•	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$						•				<p>Compact notation: (by 1 digit)</p>  <p>Long multiplication:</p>  <p>Compact with decimals:</p> 
10 000	1000	100	10	1	•	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$													
					•																

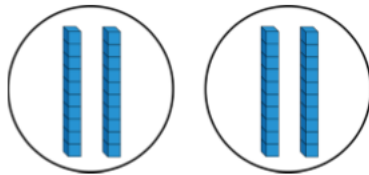
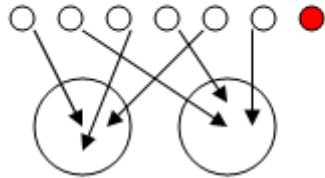
	Year 6
<p>Layers of vocabulary</p>  <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      lots of, groups of times, multiply, multiplication, multiplied by multiple of, product once, twice, three times... ten times... times as (big, long, wide... and so on) repeated addition array row, column double, halve share, share equally                      factor, multiple, prime, composite</p> <p><b>Instructional vocabulary:</b>                      carry on, continue, repeat what comes next? predict, describe the pattern, describe the rule                      find, find all, find different, investigate</p>

Division

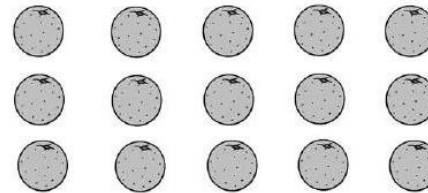
Year 1 - Division			
Objective and Strategies	Concrete	Pictorial	Abstract
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      count in ones, twos... tens...                      share, groups of, equal groups                      odd, even</p> <p><b>Instructional vocabulary:</b>                      count out, share out, left, left over</p>		
<p>To understand that division is sharing into equal groups.</p>	<p>I have 10 cubes, can you share them equally in 2 groups?</p>	<p>Children use pictures or shapes to share quantities.</p> <p>Children represent objects by drawing circles and dots.</p>	<p>Share 9 buns between three people. Children could draw dots to support them.</p>

Year 2 – Division			
Objective and Strategies	Concrete	Pictorial	Abstract
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p> <p>Basic to subject specific (Beck's Tiers): share, share equally one each, two each, three each... group in pairs, threes... tens equal groups of <math>\div</math>, divide, divided by, divided into left, left over</p> <p>Instructional vocabulary: tell me, describe, name, pick out, discuss, talk about, explain, explain your method, explain how you got your answer, give an example of... show how you</p>	<p>Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.</p>	<p>Use a number line to show jumps in groups. The number of jumps equals the number of groups.</p> <p>Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.</p>	<p><math>20 \div 5 = 4</math></p> <p>Divide 25 into 5 groups. How many are in each group?</p>

There are 7 cakes and 2 children. How many cakes will they each get?  
 'Leftovers' introduced.



$$40 \div 2 = 20$$



$$\begin{array}{l} \text{15 divided by} \\ \text{3} = 5 \end{array}$$

$$\begin{array}{l} \text{15 divided by} \\ \text{5} = 3 \end{array}$$

Find the inverse of multiplication and division sentences by creating four linking number sentences.

$$7 \times 5 = 35$$

$$5 \times 7 = 35$$

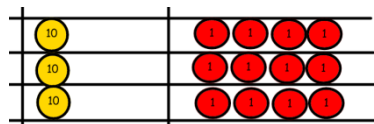
$$35 \div 7 = 5$$

$$35 \div 5 = 7$$

Year 3 – Division			
Objective and Strategies	Concrete	Pictorial	Abstract
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b>                      share, share equally one each, two each, three each...                      group in pairs, threes... tens equal groups of ÷, divide, division, divided by, divided into left, left over, remainder, dividend, divisor</p> <p><b>Instructional vocabulary:</b>                      calculate, work out, solve, investigate, question, answer, check</p>		
<p>To understand division as sharing and grouping.</p> <p>To know when a remainder will occur, and how to write it using 'r' notation.</p> <p>To know how to rearrange the dividend in the multiples of the divisor.</p>	<p><math>96 \div 3 = 32</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Use place value counters to build the dividend (in this example this is 96).</p> </div>	<p><math>63 \div 3</math></p> <p>Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.</p>	<div style="border: 1px solid black; padding: 5px;"> <p><b>Use partitioning/re-arranging to find multiples of the divisor.</b>  <math>48 \div 3 =</math>                      'What do I know about 3 x tables?'                      "I know <math>3 \times 10 = 30</math>."  <math display="block">\begin{array}{r} 30 \quad 18 \\ \downarrow \quad \downarrow \\ 10 \quad 6 \end{array}</math> <math>48 \div 3 = 16</math>  <math>10 \times 3 = 30 \quad 6 \times 3 = 18</math></p> </div> <p>Complete written divisions and show the remainder using r.</p> <p><math>29 \div 8 = 3 \text{ REMAINDER } 5</math>  <math display="block">\begin{array}{ccccccc} \uparrow &amp; \uparrow &amp; \uparrow &amp; &amp; \uparrow &amp; &amp; \\ \text{dividend} &amp; \text{divisor} &amp; \text{quotient} &amp; &amp; \text{remainder} &amp; &amp; \end{array}</math></p>

Year 4 - Division									
Objective and Strategies	Concrete	Pictorial	Abstract						
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b> share, share equally one each, two each, three each... group in pairs, threes... tens equal groups of <math>\div</math>, divide, division, divided by, divided into left, left over, remainder, dividend, divisor</p> <p><b>Instructional vocabulary:</b> calculate, work out, solve, investigate question, answer, check</p>								
<p>To be able to use short division (this is with a single digit divisor).</p> <p>Continue to use the rearranging the dividend method.</p>	<p>Use place value counters to divide using the bus stop method alongside</p> <p>Calculations <math>42 \div 3</math></p> <p><math>42 \div 3 =</math></p> <p>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.</p> <p>We exchange this ten for ten ones and then share the ones equally among the groups.</p>	<div style="border: 1px solid black; padding: 10px;"> <p>Continue to develop partitioning/re-arranging to find multiples of the divisor.</p> <p><math>96 \div 6</math></p> <p>"What do I know? <math>6 \times 10 = 60</math>"</p> <table style="margin-left: 20px;"> <tr> <td style="padding: 0 10px;"><math>60</math></td> <td><math>36</math></td> </tr> <tr> <td style="text-align: center;"><math>\downarrow</math></td> <td style="text-align: center;"><math>\downarrow</math></td> </tr> <tr> <td style="padding: 0 10px;"><math>10</math></td> <td><math>6</math></td> </tr> </table> <p><math>96 \div 6 = 16</math></p> </div> <p>Encourage them to move towards counting in multiples to divide more efficiently.</p>	$60$	$36$	$\downarrow$	$\downarrow$	$10$	$6$	<p>Begin with divisions that divide equally with no carrying.</p> <p>Then move to divisions with carrying which do not result in a remainder.</p>
$60$	$36$								
$\downarrow$	$\downarrow$								
$10$	$6$								





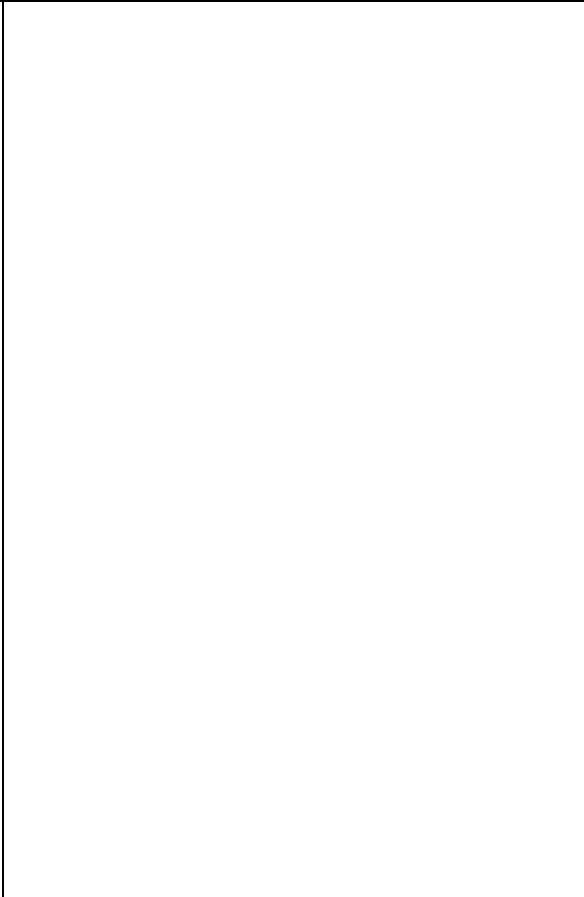
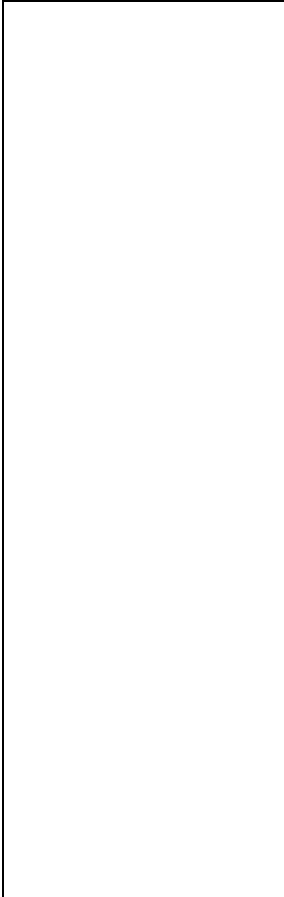
We look how much in 1 group so the answer is 14.

Move onto divisions with a remainder.

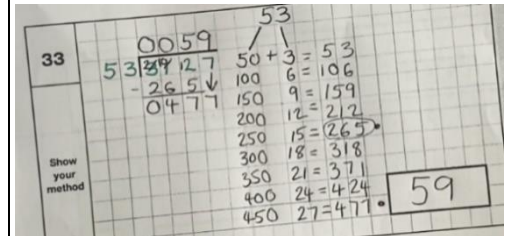
		0	9	2	r3
5		4	6	13	

Year 5 - Division			
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p>	<p><b>Basic to subject specific (Beck's Tiers):</b> equal groups of, divide, division, divided by, divided into remainder, factor, quotient, divisible by, inverse</p> <p><b>Instructional vocabulary:</b> calculate, work out, solve, investigate question, answer, check same, different missing number/s number facts, number pairs, number bonds, greatest value, least value</p>		
Objective and Strategies	Concrete	Pictorial	Abstract
<p>To be able to use short division (this is with a single digit divisor), with up to 4 digit dividends.</p> <p>To apply my knowledge of the tests of divisibility.</p> <p>To divide by 10, 100 and 1000 mentally.</p> <p>Continue to use the rearranging the dividend method.</p>	<p>Understanding the effect of dividing by 10, 100 and 1000.</p> <p>Go back and use place value counters if children do not understand (see year 3 division).</p>	<div style="border: 1px solid black; padding: 10px;"> <p><math>847 \div 7</math>                      "What do I know? I know <math>7 \times 12 = 84</math>                      so <math>7 \times 120 = 840</math>"</p> <math display="block">\begin{array}{r} 847 \\ 840 \quad 7 \\ \downarrow \quad \downarrow \\ 120 \quad 1 \end{array}</math> <p><math>847 \div 7 = 121</math></p> </div> <p>Encourage them to move towards counting in multiples to divide more efficiently.</p>	<p>To complete divisions with a remainder.</p>

Year 6 - Division			
Objective and Strategies	Concrete	Pictorial	Abstract
<p>Layers of vocabulary</p> <p>Beck's Tiers of Vocabulary</p> <p>Basic to subject specific (Beck's Tiers): equal groups of, divide, division, divided by, divided into remainder, factor, quotient, divisible by, inverse, remainders as fractions or decimals</p> <p>Instructional vocabulary: calculate, work out, solve, investigate question, answer, check, same, different missing number/s number facts, number pairs, number bonds greatest value, least value</p>	<p><math>17 \div 5 = 3 \frac{2}{5}</math></p> <p>Use the number line to explore remainders and expressing the quotient as a fraction or decimal.</p>	<p><math>581 \div 7 =</math></p> <p><math>560 + 21 = 581</math></p> <p><math>80 + 3 = 83</math></p> <p>Encourage them to move towards counting in multiples to divide more efficiently.</p>	<p>Short division where the remainder is a decimal</p> <p>Short division where the remainder is a fraction</p>



Long division



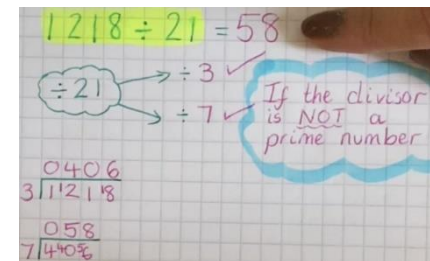
33  $\overline{) 59}$   
 $\underline{- 26}$  59  
 04 77

53  
 3 = 53  
 6 = 106  
 9 = 159  
 12 = 212  
 15 = 265  
 18 = 318  
 21 = 371  
 24 = 424  
 27 = 477

Show your method

59

Factor pair division



$1218 \div 21 = 58$

$\div 21 \rightarrow \div 3$  ✓  
 $\rightarrow \div 7$  ✓

If the divisor is NOT a prime number

$\begin{array}{r} 0406 \\ 3 \overline{) 1218} \\ \underline{058} \end{array}$