

# St Agnes' Catholic Primary School



## Calculation Policy

*-The family of St Agnes loves, learns and grows together as followers of Jesus*

## **St Agnes' Calculation Policy**

The following calculation policy has been devised to meet requirements of the National Curriculum 2014 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school.

The National Curriculum for mathematics aims to ensure that all pupils:

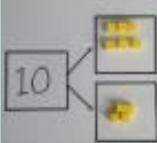
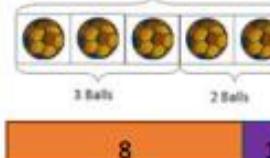
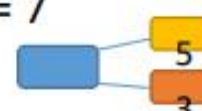
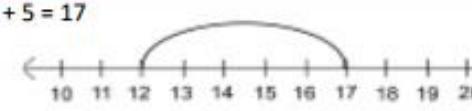
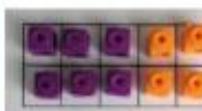
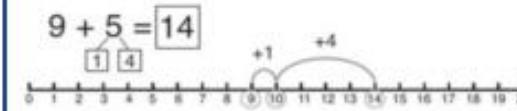
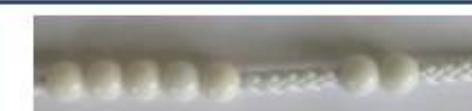
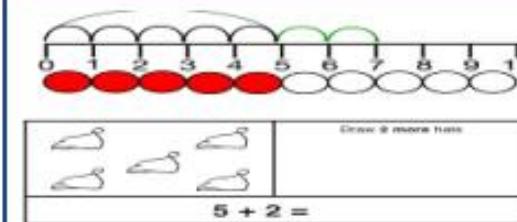
- become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately
- reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions

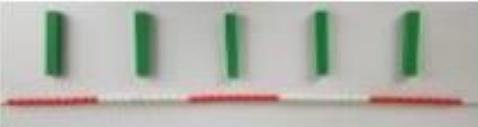
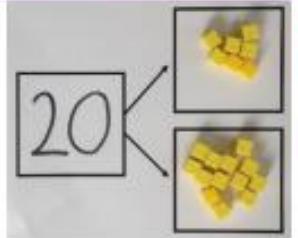
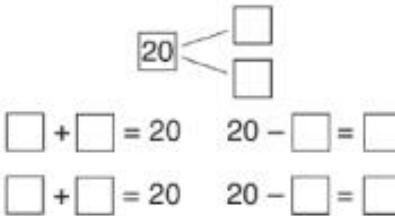
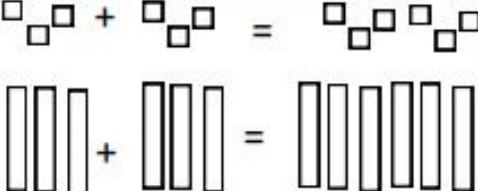
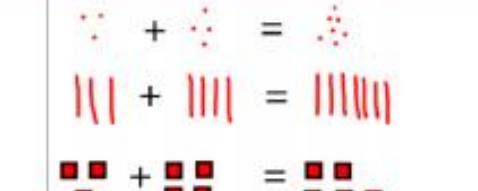
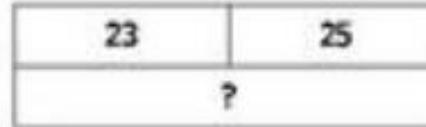
At St Agnes, we are particularly focusing on the progression of calculation using concrete resources and pictorial representations, before progressing on to the abstract. Concrete, pictorial, abstract (CPA) is a highly effective approach to teaching, that develops a deep and sustainable understanding of maths. Developed by American psychologist, Jerome Bruner, the CPA approach is the mainstay of maths teaching in Singapore. The CPA approach is a gradual and systematic approach, which builds on a child's existing understanding, and provides children with a conceptual understanding of maths.



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# Y1 ADDITION

Objective & Strategy	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part- whole model	 <p>Use part part whole model.</p>  <p>Use cubes to add two numbers together as a group or in a bar.</p> 	 <p>Use pictures to add two numbers together as a group or in a bar.</p> 	$4 + 3 = 7$  <p>Use the part-part whole diagram as shown above to move into the abstract.</p> $10 = 6 + 4$
Starting at the bigger number and counting on	 <p>Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.</p>	$12 + 5 = 17$  <p>Start at the larger number on the number line and count on in ones or in one jump to find the answer.</p>	$5 + 12 = 17$ <p>Place the larger number in your head and count on the smaller number to find your answer.</p>
Regrouping to make 10. <i>This is an essential skill for column addition later.</i>	 <p><math>6 + 5 = 11</math></p>  <p>Start with the bigger number and use the smaller number to make 10.</p>  <p>Use ten frames.</p>	 <p><math>3 + 9 =</math></p> <p>Use pictures or a number line. Regroup or partition the smaller number using the part whole model to make 10.</p> 	$7 + 4 = 11$ <p>If I am at seven, how many more do I need to make 10. How many more do I add on now?</p>
Represent & use number bonds and related subtraction facts within 20	 <p>2 more than 5.</p>		<p>Emphasis should be on the language</p> <p>'1 more than 5 is equal to 6.'</p> <p>'2 more than 5 is 7.'</p> <p>'8 is 3 more than 5.'</p>

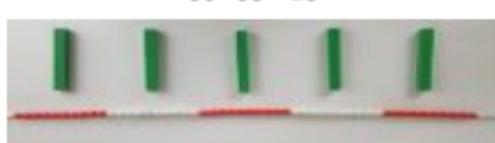
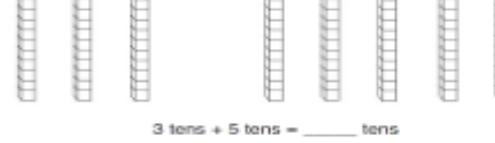
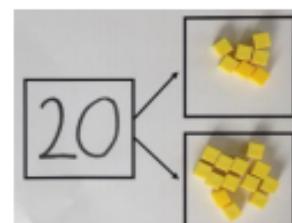
Objective & Strategy	Concrete	Pictorial	Abstract
Adding multiples of ten	$50 + 30 = 80$  Model using dienes and bead strings	 $3 \text{ tens} + 5 \text{ tens} = \underline{\hspace{2cm}} \text{ tens}$ $30 + 50 = \underline{\hspace{2cm}}$ Use representations for base ten.	$20 + 30 = 50$ $70 = 50 + 20$ $40 + \square = 60$
Use known number facts Part part whole	 Children explore ways of making numbers within 20	 $\square + \square = 20$ $20 - \square = \square$ $\square + \square = 20$ $20 - \square = \square$	$\square + 1 = 16$ $16 - 1 = \square$ $1 + \square = 16$ $16 - \square = 1$
Using known facts	$\square \square + \square \square = \square \square \square \square$ 	 Children draw representations of H,T and O	$3 + 4 = 7$ <i>leads to</i> $30 + 40 = 70$ <i>leads to</i> $300 + 400 = 700$
Bar model	 $3 + 4 = 7$	 $7 + 3 = 10$	 $23 + 25 = 48$

# Y2

# AS

# Addition

# +

Objective & Strategy	Concrete	Pictorial	Abstract				
Adding multiples of ten	$50 + 30 = 80$  Model using dienes and bead strings	 3 tens + 5 tens = ____ tens $30 + 50 = \underline{\hspace{2cm}}$ Use representations for base ten.	$20 + 30 = 50$ $70 = 50 + 20$ $40 + \square = 60$				
Use known number facts Part part whole	 Children explore ways of making numbers within 20	$20 \leftarrow \square \quad \square$ $\square + \square = 20 \quad 20 - \square = \square$ $\square + \square = 20 \quad 20 - \square = \square$	$\square + 1 = 16 \quad 16 - 1 = \square$ $1 + \square = 16 \quad 16 - \square = 1$				
Using known facts	$\square \square + \square \square = \square \square \square \square$ $\square \square \square + \square \square \square = \square \square \square \square \square \square$	$\square + \square = \square$ $\square + \square = \square$ $\square + \square = \square$ Children draw representations of H,T and O	$3 + 4 = 7$ <i>leads to</i> $30 + 40 = 70$ <i>leads to</i> $300 + 400 = 700$				
Bar model	 $3 + 4 = 7$	 $7 + 3 = 10$	<table border="1" style="width: 100px; text-align: center;"> <tr> <td>23</td> <td>25</td> </tr> <tr> <td colspan="2">?</td> </tr> </table> $23 + 25 = 48$	23	25	?	
23	25						
?							

# Y3 A3 ADDITION

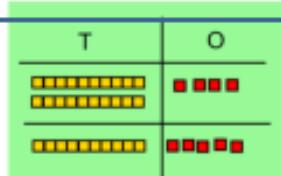
## Objective & Strategy

### Concrete

### Pictorial

### Abstract

Column Addition—no regrouping (friendly numbers)



Model using Dienes or numicon

Children move to drawing the counters using a tens and one frame.

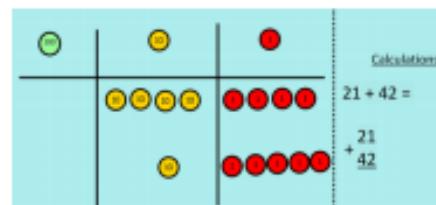
2 2 3

+ 1 1 4

3 3 7

Add two or three 2 or 3-digit numbers.

Tens	Units
4 5	
3 4	
7	9



Move to using place value counters

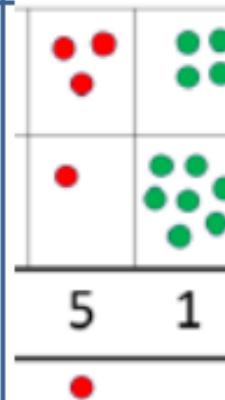
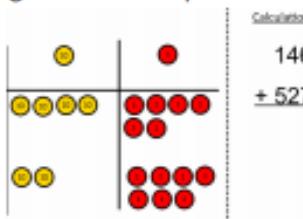


Add the ones first, then the tens, then the hundreds.

Column Addition with regrouping.

Tens	Units
3 9	
1 5	
5	

Exchange ten ones for a ten. Model using numicon and pv counters.



Children can draw a representation of the grid to further support their understanding, carrying the ten underneath the line

$$\begin{array}{r}
 20 + 5 \\
 40 + 8 \\
 \hline
 60 + 13 = 73
 \end{array}$$

1 1

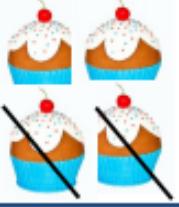
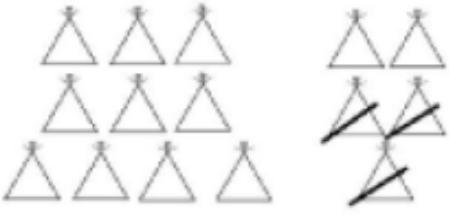
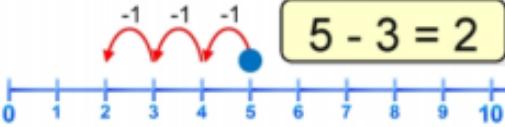
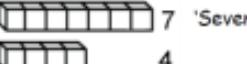
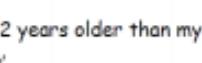
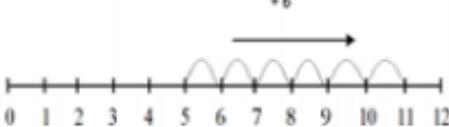
Start by partitioning the numbers before formal column to show the exchange.

$$\begin{array}{r}
 536 \\
 + 85 \\
 \hline
 621
 \end{array}$$

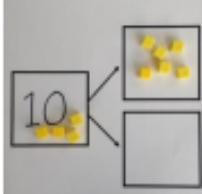
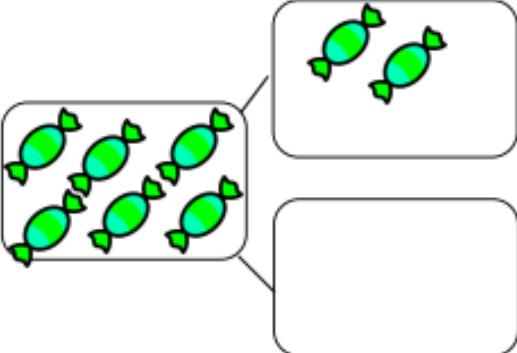
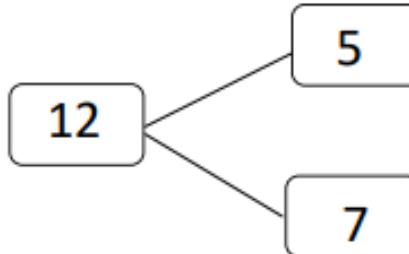
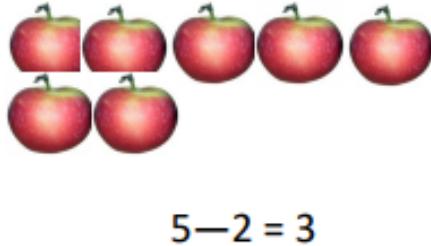
Y4-6

# ADDITION

Objective & Strategy	Concrete	Pictorial	Abstract										
Y4—add numbers with up to 4 digits	<p>Children continue to use dienes or pv counters to add, exchanging ten ones for a ten and ten tens for a hundred and ten hundreds for a thousand.</p> <table border="1"> <thead> <tr> <th>Hundreds</th> <th>Tens</th> <th>Ones</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Hundreds	Tens	Ones							<p>Draw representations using pv grid.</p>	$  \begin{array}{r}  & 1 & 1 \\  & 3 & 5 & 1 & 7 \\  + & 3 & 9 & 6 \\  \hline  & 3 & 9 & 1 & 3  \end{array}  $ <p>Continue from previous work to carry hundreds as well as tens.</p>	
Hundreds	Tens	Ones											
Y5—add numbers with more than 4 digits. Add decimals with 2 decimal places, including money.	<p>As year 4</p> <table border="1"> <thead> <tr> <th>tens</th> <th>ones</th> <th>•</th> <th>tenths</th> <th>hundredths</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Introduce decimal place value counters and model exchange for addition.</p>	tens	ones	•	tenths	hundredths						<p>2.37 + 81.79</p>	$  \begin{array}{r}  & 1 & 1 \\  & 7 & 2 & 8 \\  + & 5 & 4 & 6 \\  \hline  & 1 & 2 & 7 & 4  \end{array}  $ $  \begin{array}{r}  & 1 & 1 & 1 \\  & 2 & 3 & . & 5 & 9 \\  + & 7 & . & 5 & 5 \\  \hline  & 3 & 1 & . & 1 & 4  \end{array}  $
tens	ones	•	tenths	hundredths									
Y6—add several numbers of increasing complexity Including adding money, measure and decimals with different numbers of decimal points.	As Y5	As Y5	$  \begin{array}{r}  & 2 & 1 & 2 \\  & 8 & 1, & 0 & 5 & 9 \\  & & 3 & 6 & 6 & 8 \\  & & 1 & 5, & 3 & 0 & 1 \\  + & 2 & 0, & 5 & 5 & 1 \\  \hline  & 1 & 2 & 0, & 5 & 7 & 9  \end{array}  $ <p>Insert zeros for place holders.</p> $  \begin{array}{r}  & 2 & 3 & . & 3 & 6 & 1 \\  & 9 & . & 0 & 8 & 0 \\  & 5 & 9 & . & 7 & 7 & 0 \\  + & 1 & . & 3 & 0 & 0 \\  \hline  & 9 & 3 & . & 5 & 1 & 1  \end{array}  $										

Objective & Strategy	Concrete	Pictorial	Abstract
Taking away ones.	<p>Use physical objects, counters, cubes etc to show how objects can be taken away.</p>  <p><math>6 - 4 = 2</math></p>  <p><math>4 - 2 = 2</math></p>	 <p><math>15 - 3 = 12</math></p> <p>Cross out drawn objects to show what has been taken away.</p>	$7 - 4 = 3$ $16 - 9 = 7$
Counting back	  <p>Move objects away from the group, counting backwards.</p> <p>Move the beads along the bead string as you count backwards.</p>	 <p><math>5 - 3 = 2</math></p> <p>Count back in ones using a number line.</p>	<p>Put 13 in your head, count back 4. What number are you at?</p>
Find the Difference	<p>Compare objects and amounts</p>  <p>7 'Seven is 3 more than four'</p>  <p>4 I am 2 years older than my sister'</p>  <p>5 Pencils 3 Erasers ?</p> <p>Lay objects to represent bar model.</p>	<p>Count on using a number line to find the difference.</p> 	<p>Hannah has 12 sweets and her sister has 5. How many more does Hannah have than her sister.?</p>

# Y1 SUBTRACTION

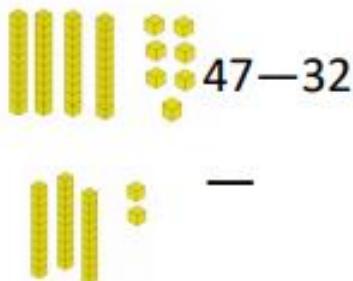
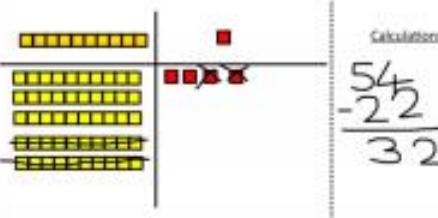
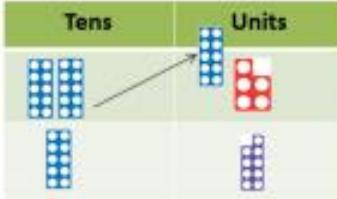
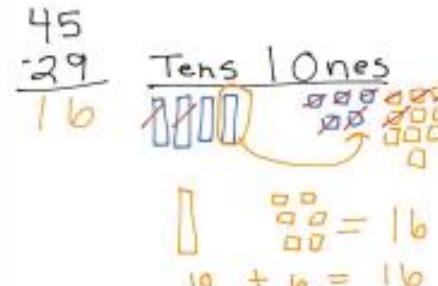
Objective & Strategy	Concrete	Pictorial	Abstract
Represent and use number bonds and related subtraction facts within 20  Part Part Whole model	 <p>Link to addition. Use PPW model to model the inverse.  If 10 is the whole and 6 is one of the parts, what's the other part?  <math>10 - 6 = 4</math></p>	 <p>Use pictorial representations to show the part.</p>	<p>Move to using numbers within the part whole model.</p> 
Make 10	<p><math>14 - 9</math></p> <p>Make 14 on the ten frame. Take 4 away to make ten, then take one more away so that you have taken 5.</p>	<p><math>13 - 7</math></p> <p>Jump back 3 first, then another 4. Use ten as the stopping point.</p>	<p><math>16 - 8</math></p> <p>How many do we take off first to get to 10? How many left to take off?</p>
Bar model	 <p><math>5 - 2 = 3</math></p>		 <p><math>10 = 8 + 2</math> <math>10 = 2 + 8</math> <math>10 - 2 = 8</math> <math>10 - 8 = 2</math></p>

Y1  
SUBTRACTION

# Y2

# SUBTRACTION

Objective & Strategy	Concrete	Pictorial	Abstract
Regroup a ten into ten ones	<p>Use a PV chart to show how to change a ten into ten ones, use the term 'take and make'</p>	<p><math>20 - 4 =</math></p>	$20 - 4 = 16$
Partitioning to subtract without regrouping. 'Friendly numbers'	<p><math>34 - 13 = 21</math></p> <p>Use Dienes to show how to partition the number when subtracting without regrouping.</p>	<p>Children draw representations of Dienes and cross off.</p> <p><math>43 - 21 = 22</math></p>	$43 - 21 = 22$
Make ten strategy <i>Progression should be crossing one ten, crossing more than one ten, crossing the hundreds.</i>	<p><math>34 - 28</math></p> <p>Use a bead bar or bead strings to model counting to next ten and the rest.</p>	<p>76    80    90    93 'counting on' to find 'difference'</p> <p>Use a number line to count on to next ten and then the rest.</p>	$93 - 76 = 17$

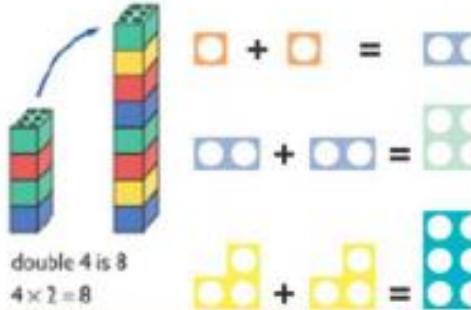
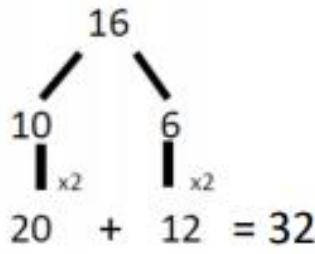
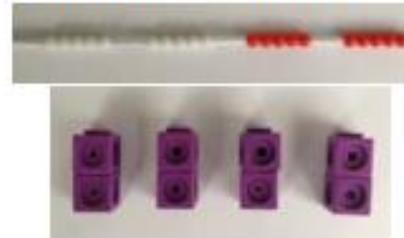
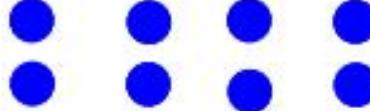
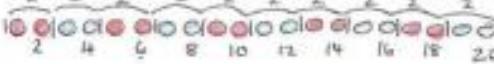
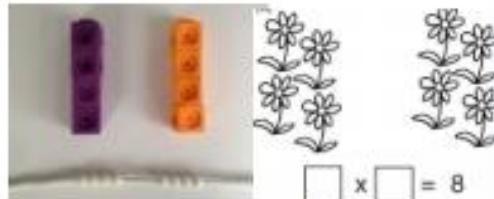
Objective & Strategy	Concrete	Pictorial	Abstract
Column subtraction without regrouping (friendly numbers)	 <p>Use base 10 or Numicon to model</p>	 <p>Draw representations to support understanding</p>	$  \begin{array}{r}  47 - 24 = 23 \\  - \frac{24}{23}  \end{array}  $ <p>Intermediate step may be needed to lead to clear subtraction understanding.</p> 
Column subtraction with regrouping	 <p>Begin with base 10 or Numicon. Move to pv counters, modelling the exchange of a ten into ten ones. Use the phrase 'take and make' for exchange.</p>	 <p>Children may draw base ten or PV counters and cross off.</p>	$  \begin{array}{r}  836 - 254 = 582 \\  - \frac{254}{582}  \end{array}  $ <p>Begin by partitioning into pv columns</p> $  \begin{array}{r}  728 - 582 = 146 \\  - \frac{582}{146}  \end{array}  $ <p>Then move to formal method.</p>

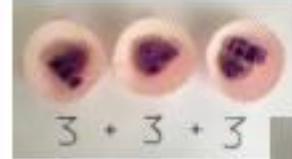
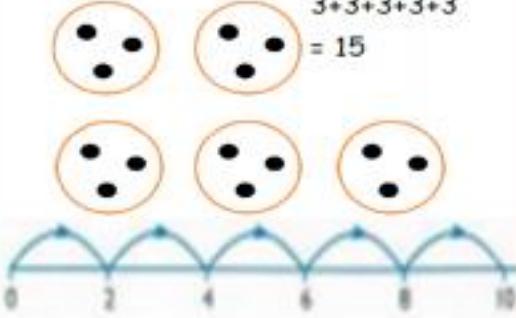
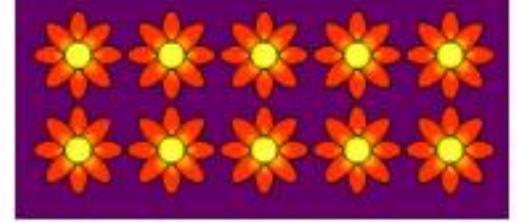
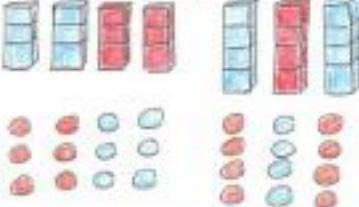
# Y3 A3 SUBTRACTION.

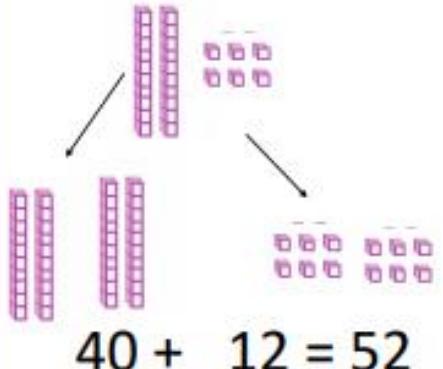
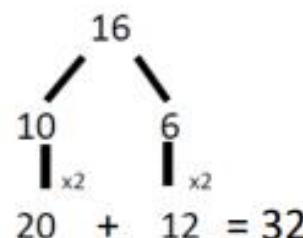
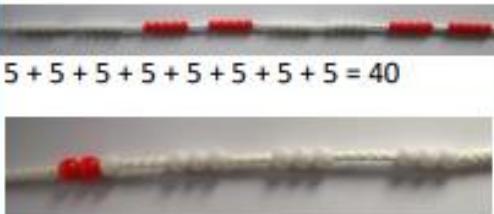
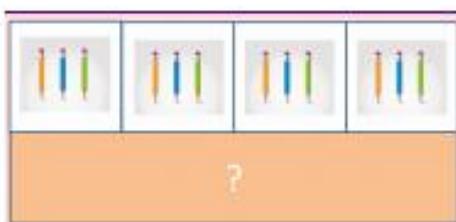
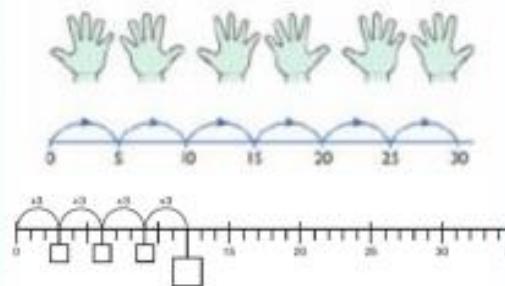
# Y4-6

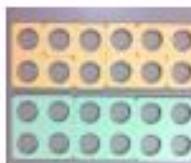
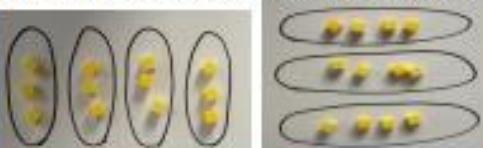
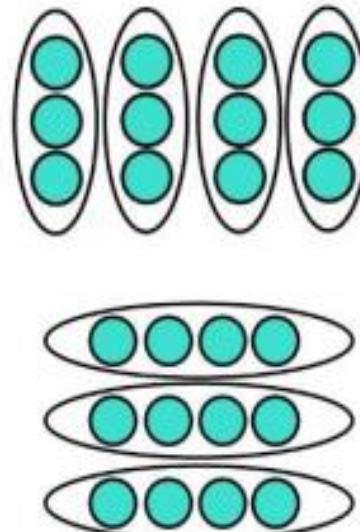
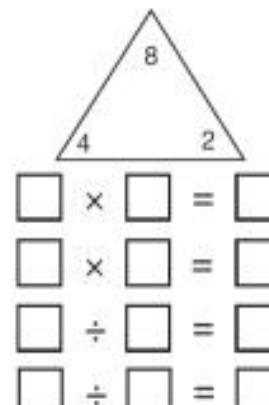
# Subtraction

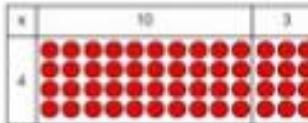
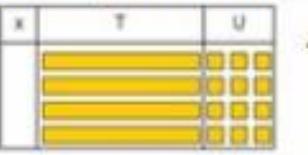
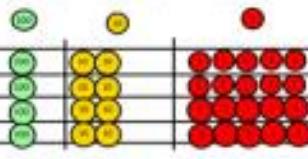
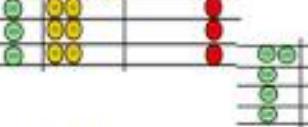
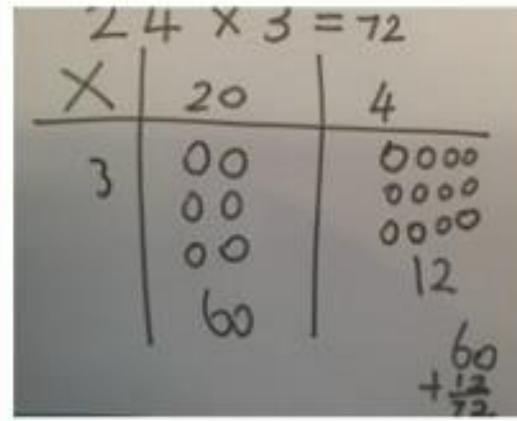
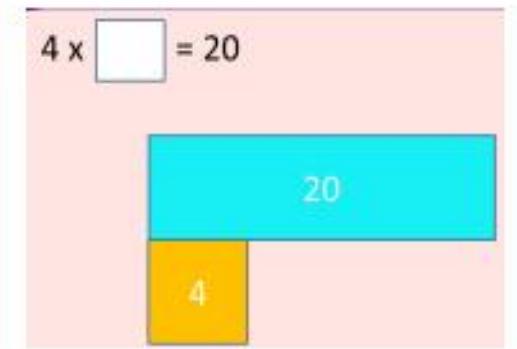
Objective & Strategy	Concrete	Pictorial	Abstract
<p>Subtracting tens and ones</p> <p>Year 4 subtract with up to 4 digits.</p> <p>Introduce decimal subtraction through context of money</p>	<p><math>234 - 179</math></p> <p>Model process of exchange using Numicon, base ten and then move to PV counters.</p>	<p>Children to draw pv counters and show their exchange—see Y3</p>	<p>Use the phrase 'take and make' for exchange</p>
<p>Year 5- Subtract with at least 4 digits, including money and measures.</p> <p>Subtract with decimal values, including mixtures of integers and decimals and aligning the decimal</p>	<p>As Year 4</p>	<p>Children to draw pv counters and show their exchange—see Y3</p>	<p>Use zeros for place-holders.</p>
<p>Year 6—Subtract with increasingly large and more complex numbers and decimal values.</p>			

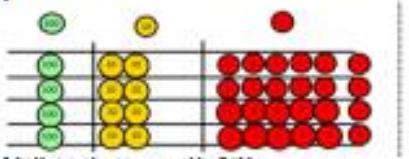
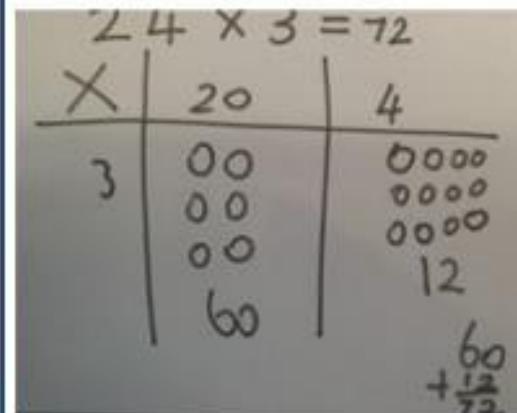
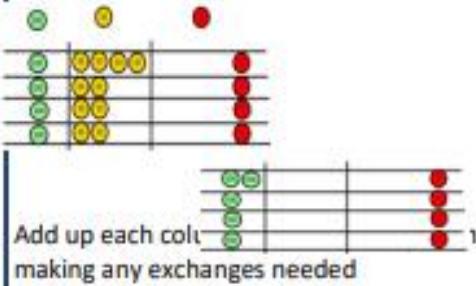
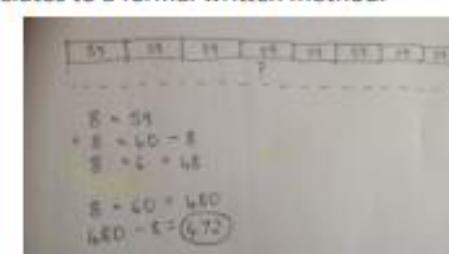
Objective & Strategy	Concrete	Pictorial	Abstract
Doubling	<p>Use practical activities using manipulatives including cubes and Numicon to demonstrate doubling</p> 	<p>Draw pictures to show how to double numbers</p> <p>Double 4 is 8</p> 	<p>Partition a number and then double each part before recombining it back together.</p>  $16$ $10 \xrightarrow{x2} 20$ $6 \xrightarrow{x2} 12$ $20 + 12 = 32$
Counting in multiples	<p>Count the groups as children are skip counting, children may use their fingers as they are skip counting.</p> 	 <p>Children make representations to show counting in multiples.</p> 	<p>Count in multiples of a number aloud.</p> <p>Write sequences with multiples of numbers.</p> <p>2, 4, 6, 8, 10</p> <p>5, 10, 15, 20, 25, 30</p>
Making equal groups and counting the total	<p>Use manipulatives to create equal groups.</p> 	<p>Draw  to show <math>2 \times 3 = 6</math></p> <p>Draw and make representations</p>	$2 \times 4 = 8$

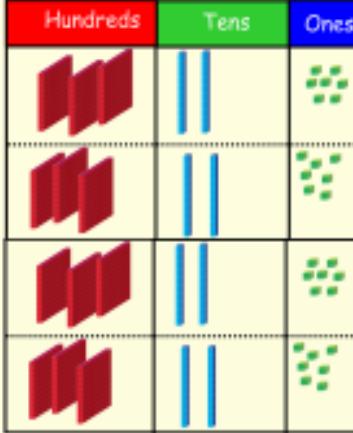
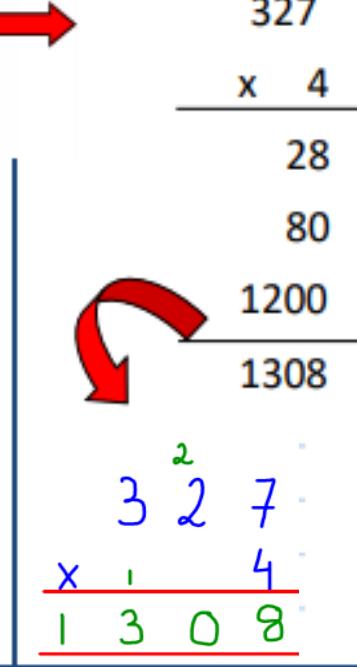
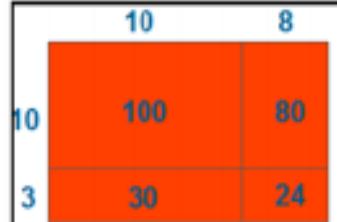
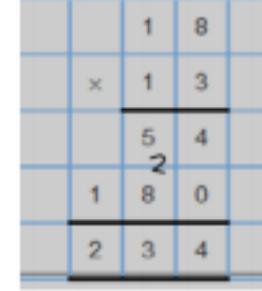
Objective & Strategy	Concrete	Pictorial	Abstract
Repeated addition	  <b>Use different objects to add equal groups</b>	<p>Use pictorial including number lines to solve prob</p> <p>There are 3 sweets in one bag. How many sweets are in 5 bags altogether?</p> <p><math>3+3+3+3+3 = 15</math></p> 	<p>Write addition sentences to describe objects and pictures.</p> <p></p> <p><math>2+2+2+2+2=10</math></p>
Understanding arrays	<p>Use objects laid out in arrays to find the answers to 2 lots 5, 3 lots of 2 etc.</p> 	<p>Draw representations of arrays to show understanding</p> 	$3 \times 2 = 6$ $2 \times 5 = 10$

Objective & Strategy	Concrete	Pictorial	Abstract
Doubling	<p>Model doubling using dienes and PV counters.</p>  $40 + 12 = 52$	<p>Draw pictures and representations to show how to double numbers</p>	<p>Partition a number and then double each part before recombining it back together.</p>  $\begin{array}{ccc} & 16 & \\ 10 & \xrightarrow{x2} & 6 \xrightarrow{x2} \\ 20 & + & 12 = 32 \end{array}$
Counting in multiples of 2, 3, 4, 5, 10 from 0 (repeated addition)	<p>Count the groups as children are skip counting, children may use their fingers as they are skip counting. Use bar models.</p>  $5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 40$ 	<p>Number lines, counting sticks and bar models should be used to show representation of counting in multiples.</p> 	<p>Count in multiples of a number aloud.</p> <p>Write sequences with multiples of numbers.</p> <p>0, 2, 4, 6, 8, 10</p> <p>0, 3, 6, 9, 12, 15</p> <p>0, 5, 10, 15, 20, 25, 30</p> $4 \times 3 = \square$

Objective & Strategy	Concrete	Pictorial	Abstract
Multiplication is commutative	<p>Create arrays using counters and cubes and Numicon.</p>    <p>Pupils should understand that an array can represent different equations and that, as multiplication is commutative, the order of the multiplication does not affect the answer.</p> 	<p>Use representations of arrays to show different calculations and explore commutativity.</p> 	$12 = 3 \times 4$ $12 = 4 \times 3$ <p>Use an array to write multiplication sentences and reinforce repeated addition.</p>  $5 + 5 + 5 = 15$ $3 + 3 + 3 + 3 + 3 = 15$ $5 \times 3 = 15$ $3 \times 5 = 15$
Using the Inverse  <i>This should be taught alongside division, so pupils learn how they work alongside each other.</i>			$2 \times 4 = 8$ $4 \times 2 = 8$ $8 \div 2 = 4$ $8 \div 4 = 2$ $8 = 2 \times 4$ $8 = 4 \times 2$ $2 = 8 \div 4$ $4 = 8 \div 2$ <p>Show all 8 related fact family sentences.</p>

Objective & Strategy	Concrete	Pictorial	Abstract															
Grid method	<p>Show the links with arrays to first introduce the grid method.</p>  <p>Move onto base ten to move towards a more compact method.</p>  <p>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</p>  <p>Fill each row with 126</p>  <p>Add up each column, starting with the ones making any exchanges needed</p>  <p>Then you have your answer.</p>	<p>Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below.</p>  <p>Bar model are used to explore missing numbers</p> 	<p>Start with multiplying by one digit numbers and showing the clear addition alongside the grid.</p> <table border="1" data-bbox="1560 325 1897 436"> <tr> <td><math>\times</math></td> <td>30</td> <td>5</td> </tr> <tr> <td>7</td> <td>210</td> <td>35</td> </tr> </table> $210 + 35 = 245$ <p>Moving forward, multiply by a 2 digit number showing the different rows within the grid method.</p> <table border="1" data-bbox="1560 762 1897 984"> <tr> <td>10</td> <td>8</td> <td></td> </tr> <tr> <td>10</td> <td>100</td> <td>80</td> </tr> <tr> <td>3</td> <td>30</td> <td>24</td> </tr> </table>	$\times$	30	5	7	210	35	10	8		10	100	80	3	30	24
$\times$	30	5																
7	210	35																
10	8																	
10	100	80																
3	30	24																

Objective & Strategy	Concrete	Pictorial	Abstract															
Grid method recap from year 3 for 2 digits x 1 digit	<p>Use place value counters to show how we are finding groups of a number. We are multiplying by 4 so we need 4 rows</p>  <p>Calculation: <math>4 \times 126</math></p>	<p>Children can represent their work with place value counters in a way that they understand. They can draw the counters using colours to show different amounts or just use the circles in the different columns to show their thinking as shown below.</p> 	<p>Start with multiplying by one digit numbers and showing the clear addition alongside the grid.</p> <table border="1" data-bbox="1572 333 1909 444"> <tr> <td><math>\times</math></td> <td>30</td> <td>5</td> </tr> <tr> <td>7</td> <td>210</td> <td>35</td> </tr> </table> $210 + 35 = 245$	$\times$	30	5	7	210	35									
$\times$	30	5																
7	210	35																
Move to multiplying 3 digit numbers by 1 digit. (year 4 expectation)	 <p>Add up each column, making any exchanges needed</p>																	
Column multiplication	<p>Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. <math>321 \times 2 = 642</math></p> <table border="1" data-bbox="377 1016 718 1445"> <tr> <th>Hundreds</th> <th>Tens</th> <th>Ones</th> </tr> <tr> <td>3</td> <td>2</td> <td>1</td> </tr> <tr> <td>2</td> <td>1</td> <td>0</td> </tr> <tr> <td>3</td> <td>2</td> <td>1</td> </tr> <tr> <td>6</td> <td>4</td> <td>2</td> </tr> </table> <p>It is important at this stage that they always multiply the ones first.</p> <p>The corresponding long multiplication is modelled alongside</p>	Hundreds	Tens	Ones	3	2	1	2	1	0	3	2	1	6	4	2	<p>The grid method may be used to show how this relates to a formal written method.</p>  <p>Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.</p>	<p>327</p> <p><math>\begin{array}{r} 327 \\ \times 4 \\ \hline 1308 \end{array}</math></p> <p>This may lead to a compact method.</p> <p><math>\begin{array}{r} 327 \\ \times 4 \\ \hline 1308 \end{array}</math></p>
Hundreds	Tens	Ones																
3	2	1																
2	1	0																
3	2	1																
6	4	2																

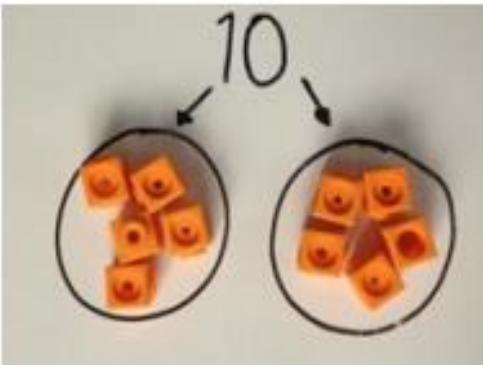
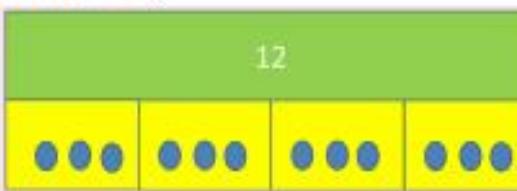
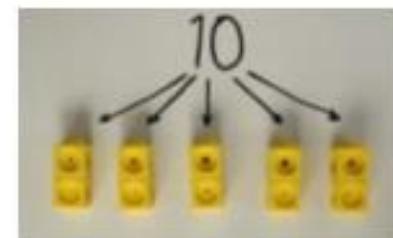
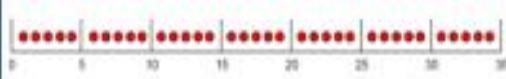
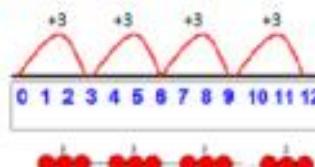
Objective & Strategy	Concrete	Pictorial	Abstract								
Column Multiplication for 3 and 4 digits x 1 digit.	 <p>It is important at this stage that they always multiply the ones first.</p> <p>Children can continue to be supported by place value counters at the stage of multiplication. This initially done where there is no regrouping. <math>321 \times 2 = 642</math></p>	<table border="1" data-bbox="990 203 1372 292"> <tr> <td>x</td> <td>300</td> <td>20</td> <td>7</td> </tr> <tr> <td>4</td> <td>1200</td> <td>80</td> <td>28</td> </tr> </table>	x	300	20	7	4	1200	80	28	 $  \begin{array}{r}  327 \\  \times 4 \\  \hline  1308  \end{array}  $ <p>This will lead to a compact method.</p>
x	300	20	7								
4	1200	80	28								
Column multiplication	<p>Manipulatives may still be used with the corresponding long multiplication modelled alongside.</p>	 <p>Continue to use bar modelling to support problem solving</p>	 $  \begin{array}{r}  18 \\  \times 3 \\  \hline  54  \end{array}  $ <p>18 x 3 on the first row (<math>8 \times 3 = 24</math>, carrying the 2 for 20, then <math>1 \times 3</math>)</p> <p>18 x 10 on the 2nd row. Show multiplying by 10 by putting zero in units first</p> $  \begin{array}{r}  1234 \\  \times 16 \\  \hline  7404 \quad (1234 \times 6) \\  1234 \quad (1234 \times 10) \\  \hline  19744  \end{array}  $								

Objective & Strategy	Concrete	Pictorial	Abstract
Multiplying decimals up to 2 decimal places by a single digit.			<p>Remind children that the single digit belongs in the units column. Line up the decimal points in the question and the answer.</p> $  \begin{array}{r}  0 \quad \frac{1}{10} \quad \frac{1}{100} \\  3 \cdot \quad   \quad 9 \\  \times \quad 8 \\  \hline  2 \quad 5 \quad \cdot \quad 5 \quad 2  \end{array}  $ <p>① ②</p>

Y6

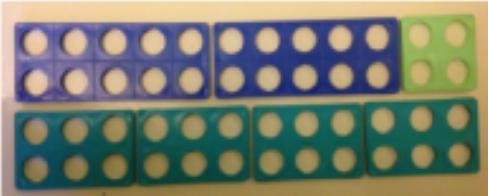
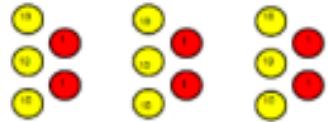
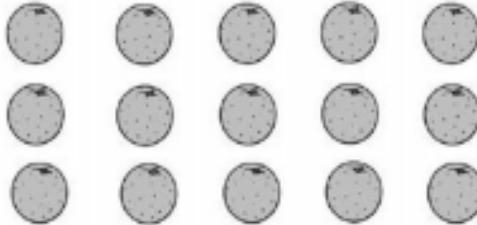
# WINTER CATALOGUE

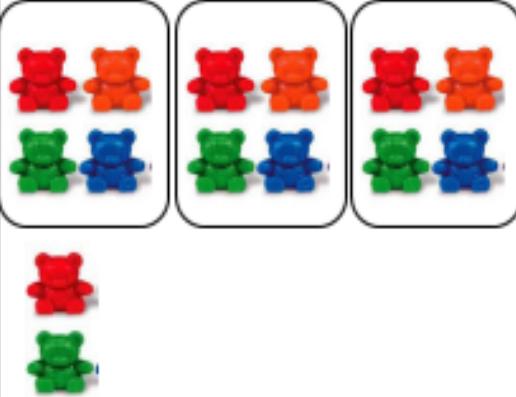
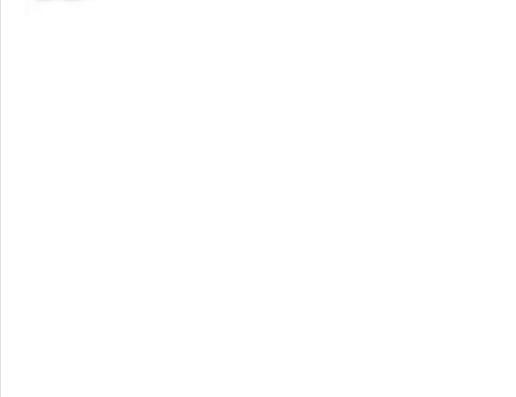
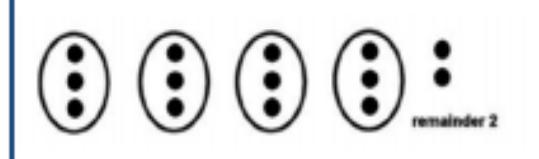
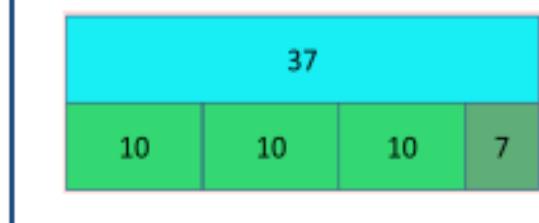
Objective & Strategy	Concrete	Pictorial	Abstract
<p>Division as sharing</p> <p><i>Use Gordon ITPs for modelling</i></p>		<p>Children use pictures or shapes to share quantities.</p> <p>8 shared between 2 is 4</p> <p>Sharing:</p> <p>12 shared between 3 is 4</p>	<p>12 shared between 3 is 4</p>

Objective & Strategy	Concrete	Pictorial	Abstract
Division as sharing	 <p>I have 10 cubes, can you share them equally in 2 groups?</p>	<p>Children use pictures or shapes to share quantities.</p>  $8 \div 2 = 4$ <p>Children use bar modelling to show and support understanding.</p>  $12 \div 4 = 3$	$12 \div 3 = 4$
Division as grouping	<p>Divide quantities into equal groups.</p> <p>Use cubes, counters, objects or place value counters to aid understanding.</p>  	<p>Use number lines for grouping</p>  <p><b>12 ÷ 3 = 4</b> 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>  $20 \div 4 = ?$ $5 \times ? = 20$	$28 \div 7 = 4$ <p>Divide 28 into 7 groups. How many are in each group?</p>

# Y3

# Y3 A3 Division

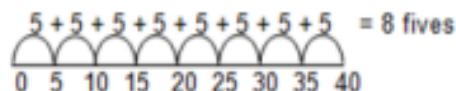
Objective & Strategy	Concrete	Pictorial	Abstract
Division as grouping	<p>Use cubes, counters, objects or place value counters to aid understanding.</p>  <p>24 divided into groups of 6 = 4</p> $96 \div 3 = 32$ 	<p>Continue to use bar modelling to aid solving division problems.</p>  $20 \div 5 = ?$ $5 \times ? = 20$	<p>How many groups of 6 in 24?</p> $24 \div 6 = 4$
Division with arrays	 <p>Link division to multiplication by creating an array and thinking about the number sentences that can be created.</p> <p>Eg <math>15 \div 3 = 5</math>   <math>5 \times 3 = 15</math></p> <p><math>15 \div 5 = 3</math>   <math>3 \times 5 = 15</math></p>	<p>Draw an array and use lines to split the array into groups to make multiplication and division sentences</p> 	<p>Find the inverse of multiplication and division sentences by creating eight linking number sentences.</p> <p><math>7 \times 4 = 28</math>  <math>4 \times 7 = 28</math>  <math>28 \div 7 = 4</math>  <math>28 \div 4 = 7</math>  <math>28 = 7 \times 4</math>  <math>28 = 4 \times 7</math>  <math>4 = 28 \div 7</math>  <math>7 = 28 \div 4</math></p>

Objective & Strategy	Concrete	Pictorial	Abstract
Division with remainders.	$14 \div 3 =$ Divide objects between groups and see how much is left over  	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder.  Use bar models to show division with remainders. 	Complete written divisions and show the remainder using r. $29 \div 8 = 3 \text{ REMAINDER } 5$ 

Example without remainder:

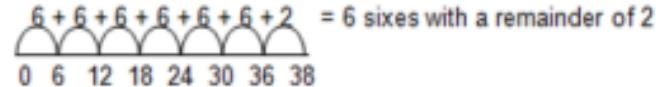
$$40 \div 5$$

Ask "How many 5s in 40?"



Example with remainder:

$$38 \div 6$$



For larger numbers, when it becomes inefficient to count in single multiples, bigger jumps can be recorded using known facts.

Objective & Strategy	Concrete	Pictorial	Abstract
<p>3</p> <p>Divide at least 3 digit numbers by 1 digit.</p> <p>Short Division</p> <p><math>96 \div 3</math></p> <p>Tens      Units</p> <p>3      2</p> <p></p> <p>Use place value counters to divide using the bus stop method alongside</p> <p></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></p> <p>We exchange this ten for ten ones and then share the ones equally among the groups.</p> <p></p> <p>We look how much in 1 group so the answer is 14.</p>	<p><math>42 \div 3</math></p> <p>Calculations</p> <p><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> <p>We look how much in 1 group so the answer is 14.</p>	<p>Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.</p> <p></p> <p>Encourage them to move towards counting in multiples to divide more efficiently.</p> <p><u>Year 4 Chunking:</u></p> <p></p>	<p>Begin with divisions that divide equally with no remainder.</p> <p><math>218 \div 4</math></p> <p>Move onto divisions with a remainder.</p> <p><math>86 \div 5</math></p> <p>Finally move into decimal places to divide the total accurately.</p> <p><math>14.6 \div 3.5</math></p>

# Long Division

1. Divide
2. Multiply
3. Subtract
4. Bring Down
5. (Repeat if needed)

$$\begin{array}{r} 0 2 \longdiv{1} \\ 1 3 \overline{)2 7 5 \ 2} \\ - 2 6 \downarrow \\ \hline 0 1 5 \\ - 1 3 \downarrow \\ \hline \cancel{0} \ 2 \\ - 1 3 \\ \hline 0 \ 9 \end{array}$$

Key Facts:

1 3  
2 6  
3 9  
5 2  
6 5  
7 8  
9 1  
1 0 4  
1 1 7  
1 3 0

## St Agnes' Calculation Policy

### Addition:

#### Concrete Resources:

- 100 square
- Number lines
- Bead strings
- Straws
- Dienes
- Place value cards
- Place value dice
- Place value counters
- Numicon



#### Early Years:

- ✓ Count reliably with numbers from 1 to 20, place them in order.
- ✓ Say which number is one more than a given number.
- ✓ Using quantities and objects, they add two single-digit numbers and count on to find the answer.

#### Year 1 Statutory requirements:

- ✓ Count to and across 100, forwards beginning with 0 or 1, or from any given number.
- ✓ Given a number, identify one more.
- ✓ Read, write and interpret mathematical statements involving addition (+), and equals (=) signs.
- ✓ Represent and use number bonds and related subtraction facts within 20
- ✓ Add one-digit and two-digit numbers to 20, including zero.
- ✓ Solve one-step problems that involve addition using concrete objects and pictorial representations, and missing number problems.

#### Year 2 statutory requirements:

- ✓ Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts to 100.
- ✓ Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing

number problems.

- ✓ Add numbers using concrete objects, pictorial representations, and mentally, including:
  - two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
  - Adding three one-digit numbers.
- ✓ Solve problems with addition including those involving numbers, quantities and measures.

Year 3 statutory requirements:

- ✓ Find 10 or 100 more than a given number.
- ✓ Recognise the place value of each digit in a three-digit number (hundreds, tens, and ones).
- ✓ Add numbers with up to three digits, using formal written methods of columnar addition.

Year 4 statutory requirements:

- ✓ Find 1000 more than a given number.
- ✓ Add numbers with up to 4 digits using the formal written methods of columnar addition where appropriate.
- ✓ Solve addition two-step problems in contexts, deciding which operations and methods to use and why.

Year 5 statutory requirements:

- ✓ Add whole numbers with more than 4 digits using formal written methods of columnar addition.
- ✓ Add numbers mentally, with increasingly large numbers.
- ✓ Solve addition multi-step problems in contexts, deciding which operations and methods to use and why.

Solve problems involving numbers up to three decimal places

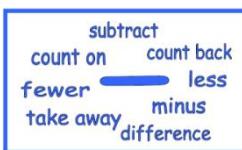
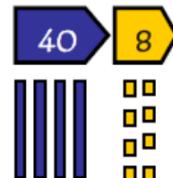
Year 6 statutory requirements:

- ✓ Pupils are expected to solve more complex addition and subtraction problems

# Subtraction

## Concrete resources:

100 square  
 Number lines  
 Bead strings  
 Straws  
 Dienes  
 Counting stick  
 Place value dice  
 Place value cards  
 Place value counters



## Early learning goals:

- ✓ Say which number is one less than a given number.
- ✓ Using quantities and objects, they subtract two single-digit numbers and count back to find the answer.

## Year 1 statutory requirements:

- ✓ Say which number is one less than a given number.
- ✓ Represent and use number bonds and related subtraction facts within 20.
- ✓ Read, write and interpret mathematical statements involving subtraction (-) and equals (=) signs.
- ✓ Subtract one-digit and two-digit numbers to 20, including zero.
- ✓ Solve one-step problems that involve subtraction using concrete objects and pictorial representations, and missing number problems.

## Year 2 statutory requirements:

- ✓ Recall and use subtraction facts to 20 fluently, and derive and use related facts to 100.

### St Agnes' Calculation Policy

- ✓ Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- ✓ Subtract numbers using concrete objects, pictorial representations, and mentally, including:
  - a two-digit number and ones
  - a two-digit number and tens
  - two two-digit numbers
  - Adding three one-digit numbers.

#### Year 3 statutory requirement:

- ✓ Find 10 or 100 less than a given number.
- ✓ Recognise the place value of each digit in a three-digit number (hundreds, tens, and ones).
- ✓ Subtract numbers with up to three digits, using formal written methods of column subtraction.
- ✓ Subtract numbers mentally, including:
  - A three-digit number and ones
  - A three-digit number and tens
  - A three-digit number and hundreds.

#### Year 4 statutory requirements:

- ✓ Find 1000 less than a given number.
- ✓ Subtract numbers with up to four digits, using formal written methods of columnar subtraction where appropriate.
- ✓ Solve subtraction two-step problems in contexts, deciding which operations and methods to use and why.

#### Year 5 statutory requirements:

- ✓ Subtract whole numbers with more than 4 digits using formal written methods of columnar subtraction.
- ✓ Subtract numbers mentally, with increasingly large numbers.
- ✓ Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
- ✓ Solve problems involving numbers up to three decimal places.

Year 6 statutory requirements: pupils are expected to solve more complex addition and subtraction problems.

# Multiplication

## Concrete resources

Place value counters

Dienes

Place value charts

Arrays

Multiplication squares

100 square

Number lines

Blank number lines

Counting stick

Early learning goal statutory requirement:

- ✓ They solve problems, including doubling, halving and sharing.

Year 1 statutory requirement:

- ✓ Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Year 2 statutory requirement:

- ✓ Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.

### St Agnes' Calculation Policy

- ✓ Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs.
- ✓ Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
- ✓ Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

#### Year 3 statutory requirements:

- ✓ Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
- ✓ Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.
- ✓ Solve problems, including missing number problems, involving multiplication including positive integer scaling problems and correspondence problems in which  $n$  objects are connected to  $m$  objects.

#### Year 4 statutory requirement:

- ✓ Recall multiplication and division facts for multiplication tables up to  $12 \times 12$
- ✓ Use place value, known and derived facts to multiply and divide mentally, including: multiply two-digit and three-digit numbers by a one-digit number using formal written layout.
- ✓ Solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as  $n$  objects are connected to  $m$  objects.

#### Year 5 statutory requirements:

- ✓ Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.
- ✓ Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

#### Year 6 statutory requirements:

- ✓ Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.
- ✓ Multiply one-digit numbers with up to two decimal places by whole numbers.

# Division

## Concrete resources:

Arrays  
Multiplication squares  
100 square  
Number lines  
Blank number lines  
Counting stick  
Place value apparatus

## Early learning goal statutory requirement:

They solve problems, including halving and sharing

## Year 1 statutory requirement:

- ✓ Solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

## Year 2 statutory requirement:

- ✓ Recall and use division facts for 2, 5 and 10 multiplication tables.
- ✓ Calculate mathematical statements for multiplication and division within the multiplication tables and write then using the multiplication (x), division (÷) and equals (=) signs.
- ✓ Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.
- ✓ ***Find 1/3; 1/4; 2/4; 3/4 of a length, shape, set of objects or quantity***

Year 3 statutory requirement:

- ✓ Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- ✓ Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- ✓ Solve problems, including missing number problems, involving division including positive integer scaling problems and correspondence problems in which  $n$  objects are connected to  $m$  objects.

Year 4 statutory requirement:

- ✓ **Note** - there isn't a statutory objective for division. However, Y4 statutory multiplication objectives are to (1) recall multiplication and division facts for multiplication tables up to  $12 \times 12$  and (2) multiply two-digit and three-digit numbers by a one-digit number using formal written layout so we will build on the connections between multiplication and division.

Year 5 statutory requirement:

- ✓ Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.

Year 6 statutory requirement:

- ✓ divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context

