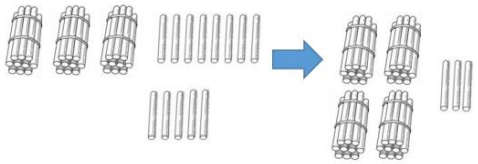
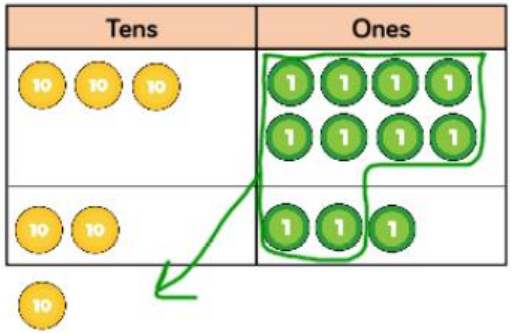
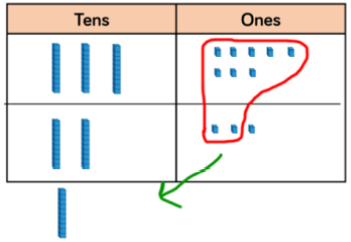
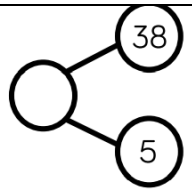
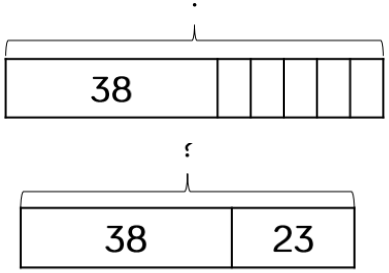
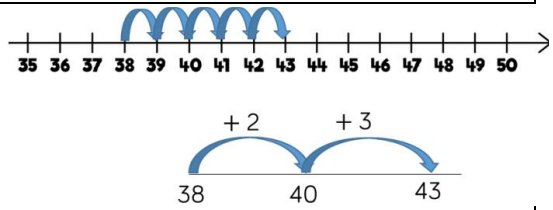
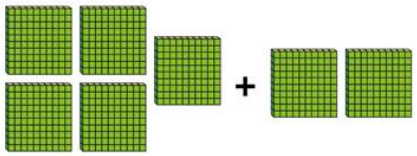
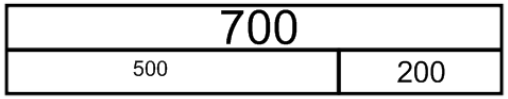
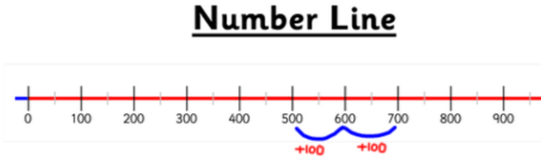
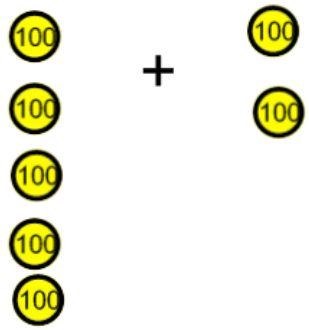
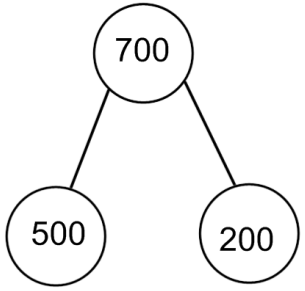
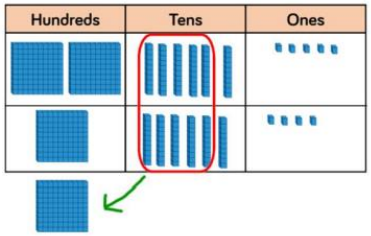
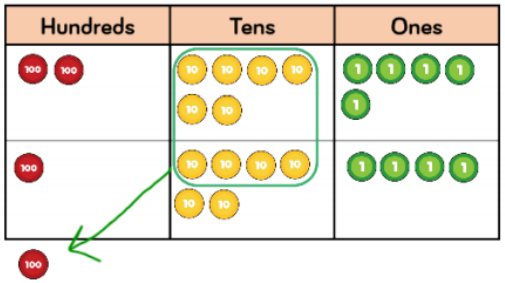
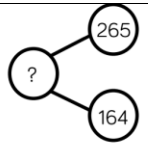
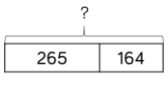
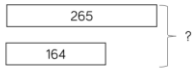
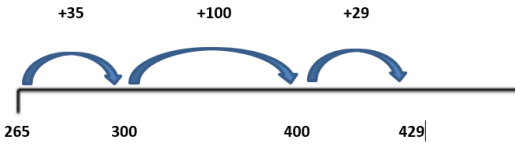
Springfield Junior School Calculation Policy

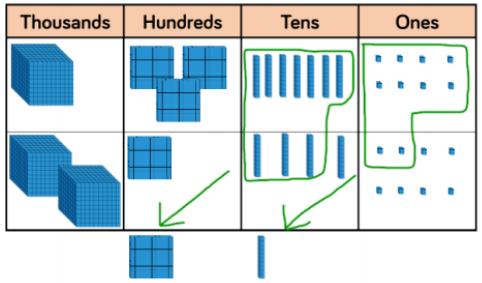
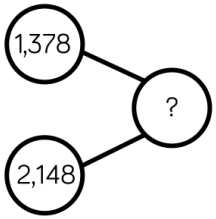
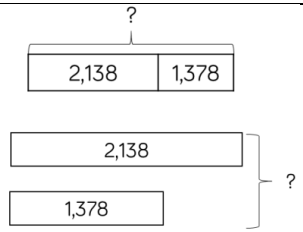
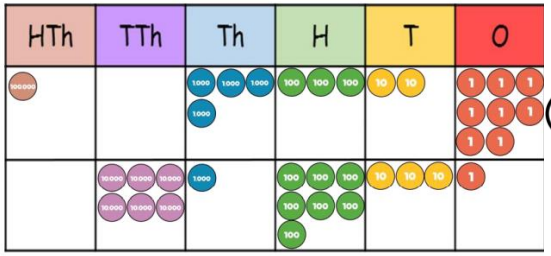
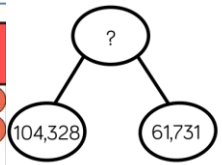
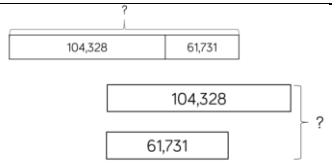
Key Points

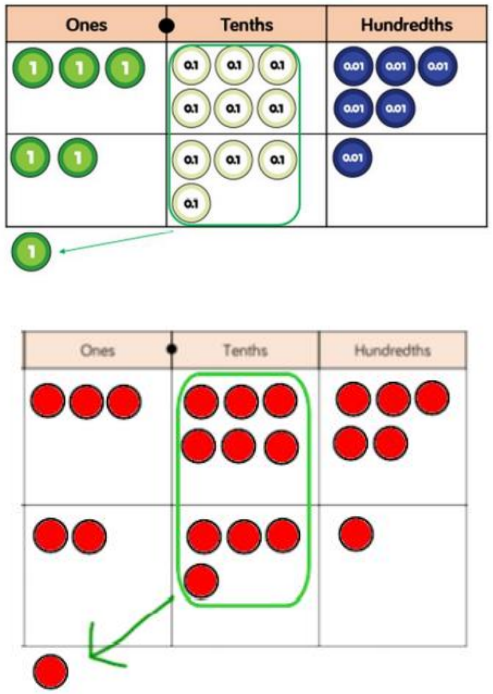
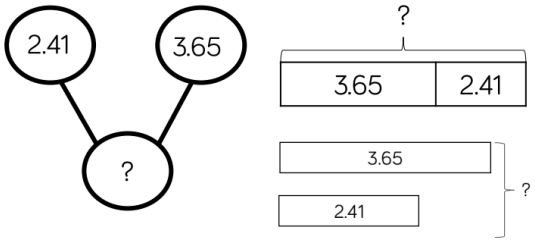
- When using concrete or pictorial representation ensure that the children write out the calculation alongside so that they can begin the see the links between these and the abstract**.**
- Ensure that different representations and methods are offered so that children can begin to make decisions about their own preference of method. This also helps to support number fluency and understanding.
- Revisit calculations aspects regularly within Fast 5/10 morning work and as mental starters
- Encourage and **model** mental methods where appropriate (e.g. times tables, doubling and halving, counting on, multiplying by multiples of 10,100 and 1000, adding or subtracting simple calculations (e.g.3467-401, 3654+106)
- Avoid using too many 'tricks' that do not lead to deeper understanding of mathematical concepts.
- When using a bar representation, model and discuss 'proportionality'.
- Model and encourage using squares in maths books when using formal methods for calculation (one digit per box; headings at the top of the columns where needed)
- Provide appropriate real life context for solving calculation problems.
- Use accurate mathematical vocabulary.

Addition

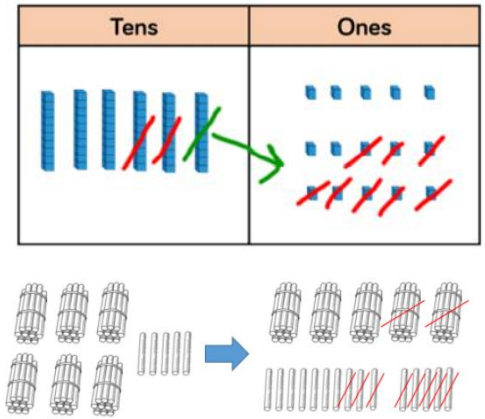
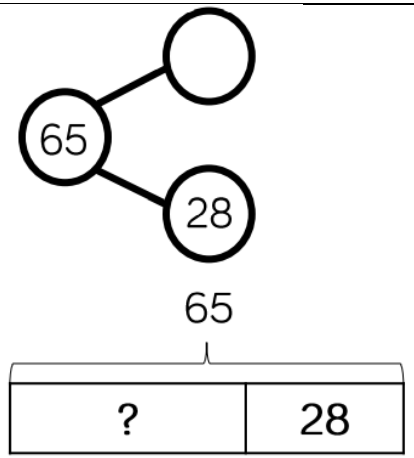
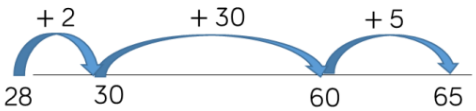
	Concrete	Pictorial	Abstract
Year 2/3 **Add 1 and 2 digit numbers to 100**	   38 + 23 61 1	 	 38 + 23 61 1
Year 3 **Add and subtract multiples of 100**	**Use dienes to represent hundreds** 	**Use a bar, counters or part-whole model to represent the addition** 	**Use a number line (mentally)** 

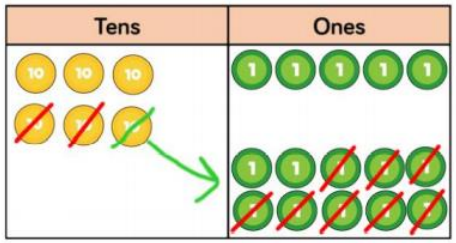
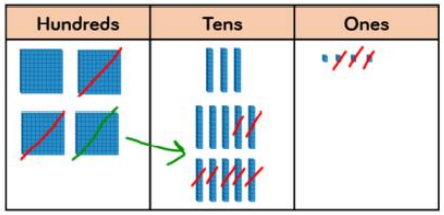
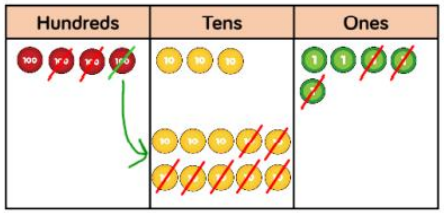
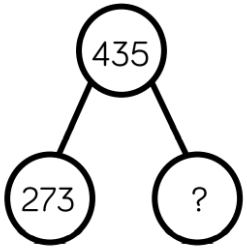
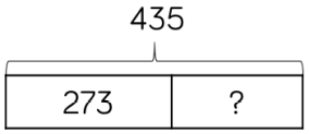
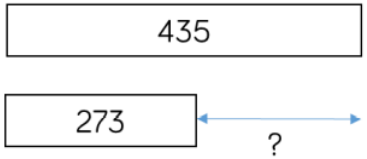
		 	
Up to 3d+3d crossing the 10s and hundreds with renaming	 265 + 164 429 1 	  	265 + 164 429 1 

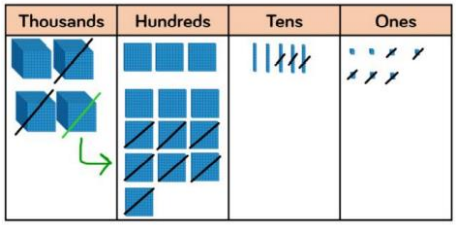
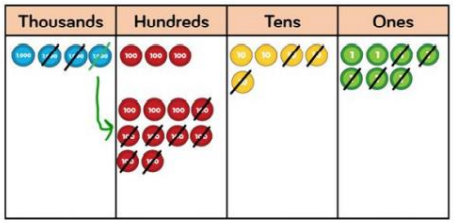
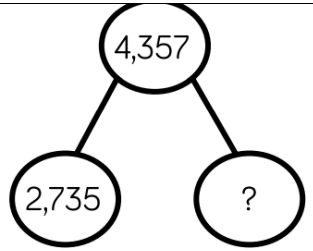
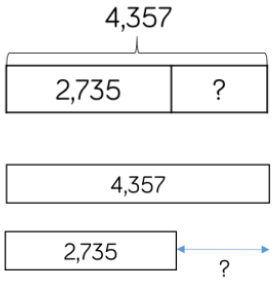
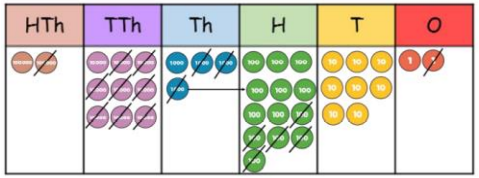
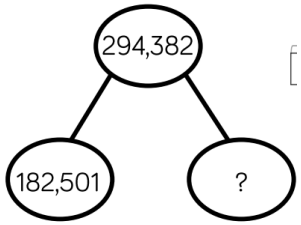
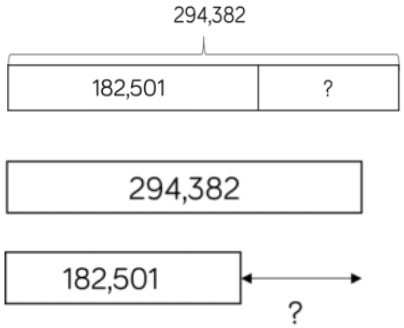
Year 4 **Add numbers up to 4d+4d**	  	  	1 3 7 8 + 2 1 4 8 3 5 2 6 1 1
Year 5/6 **Add numbers with more than 4 digits**	 	  	1 0 4 3 2 8 + 6 1 7 3 1 1 6 6 0 5 9 1

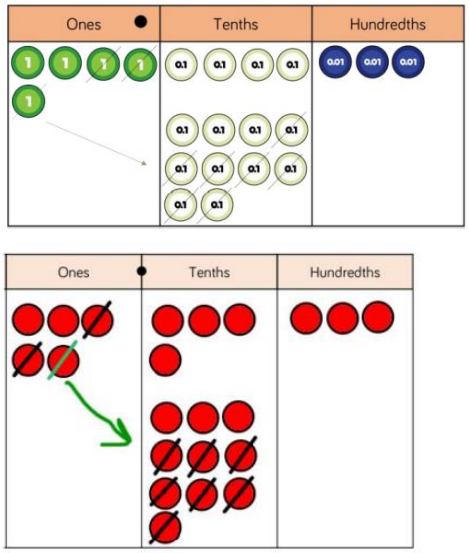
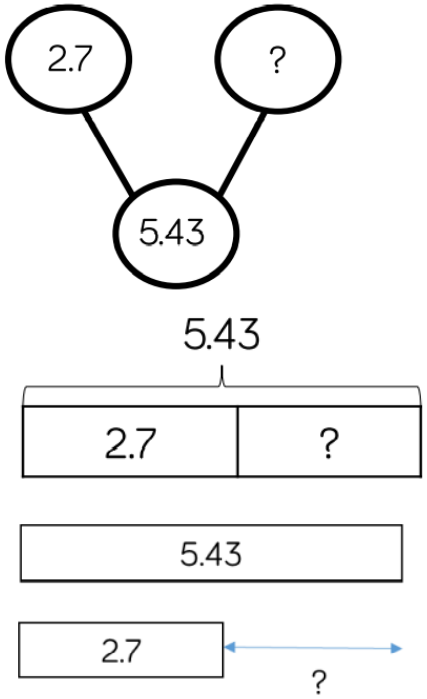
Year 5/6 Add decimals to 3dp			$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$

Subtraction

	Concrete	Pictorial	Abstract
Year 2 Subtract 1 and 2 digits from 100			 $65 - 28 = 37$

			5 1 65 − 28 37
Year 3 Subtract numbers with up to 3 digits	 	  	**435 − 273 = 262** 3 1 435 − 273 262

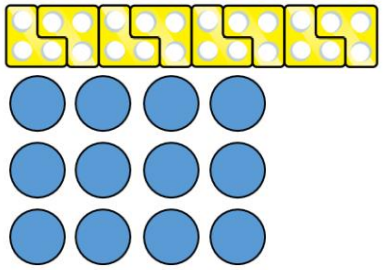
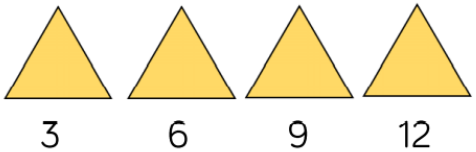
Year 4 Subtract numbers with up to 4 digits	 	 	$\begin{array}{r} {}^{3}\cancel{4}^{1}357 \\ -\ 2735 \\ \hline 1622 \\ \hline \end{array}$ **4,357 – 2,735 = 1,622**
Year 5/6 Subtract numbers with more than 4 digits		 	**294,382 – 182,501 = 111,881** $\begin{array}{r\|c\|c\|c\|c\|c\|c} & 2 & 9 & {}^{3}\cancel{4} & {}^{1}3 & 8 & 2 \\ - & 1 & 8 & 2 & 5 & 0 & 1 \\ \hline & 1 & 1 & 1 & 8 & 8 & 1 \end{array}$

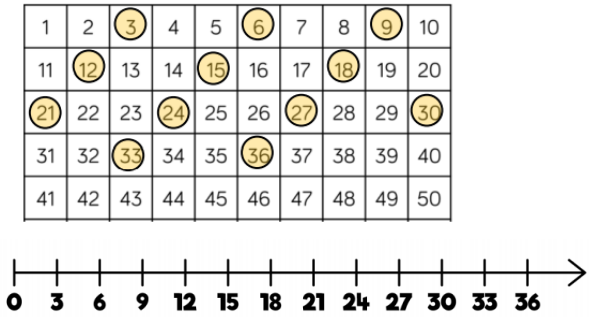
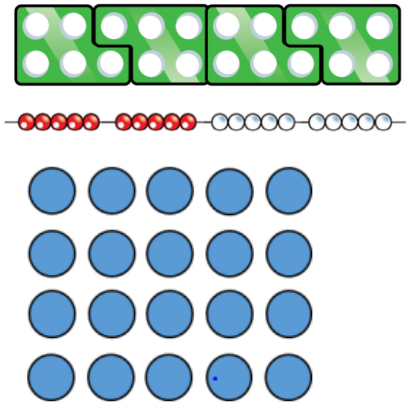
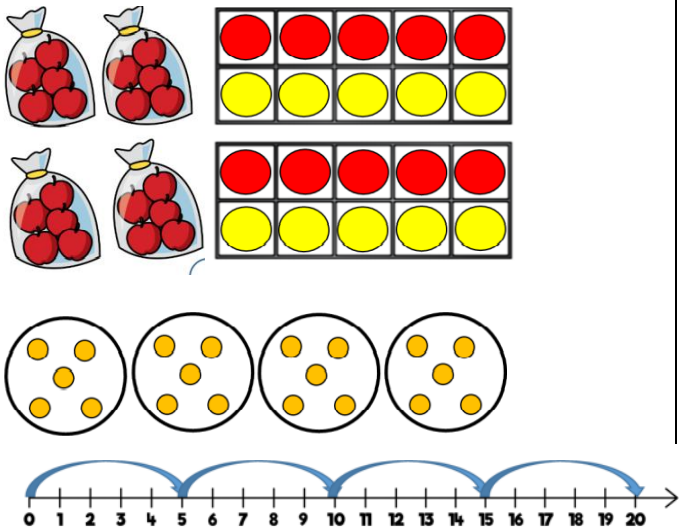
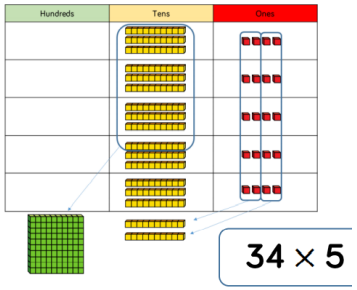
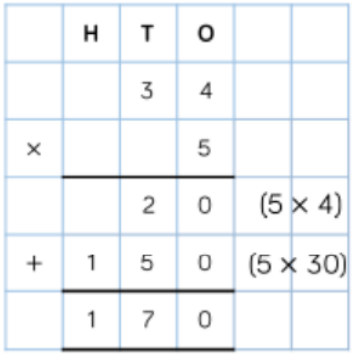
Year 5/6 Subtract numbers with up to 3 dp			$5.43 - 2.7 = 2.73$ 4 1 5.43 − 2.7 2.73

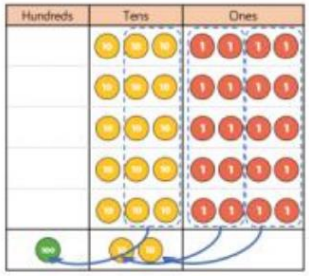
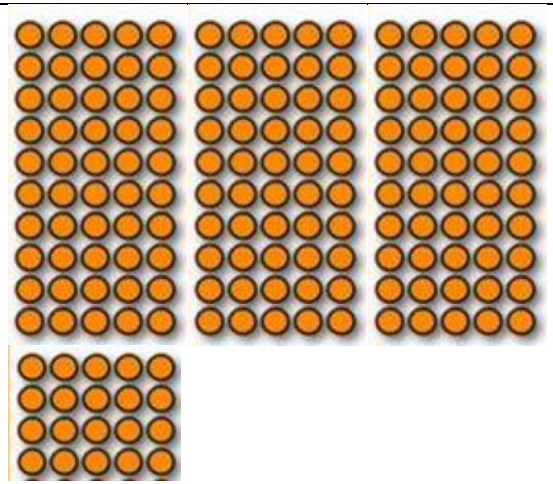
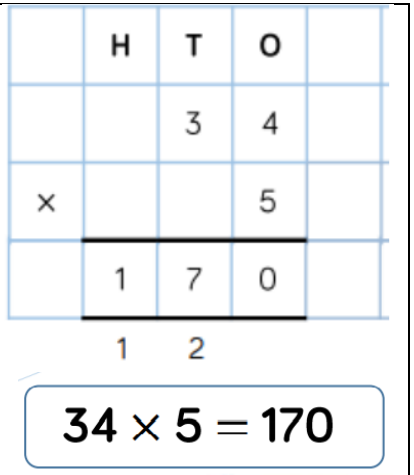
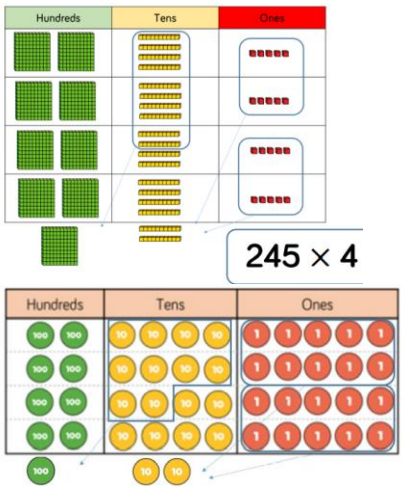
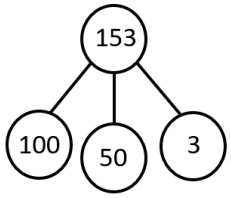
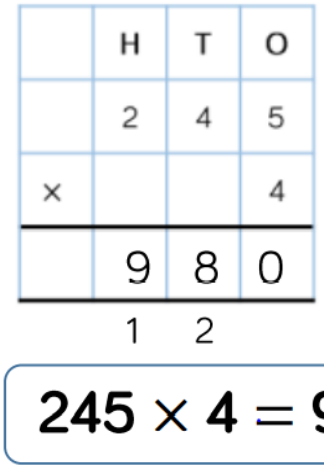
Multiplication

Key Points

- Regular counting and times table practise
- Notice and discuss patterns in times tables (Odd, Even, digital sums, doubles, halves, 10 times bigger etc)

	Concrete	Pictorial	Abstract
Times tables **Year 2** **2s, 5s, 10s** **Year 3** **3s, 4s, 8s** **Year 4** **6s, 7s, 9s, 11s, 12s**			**Written representation of table**

			
Year 2 **Solve 1 step multiplication**			One bag holds 5 apples. How many apples do 4 bags hold? $5 + 5 + 5 + 5 = 20$ $4 \times 5 = 20$ $5 \times 4 = 20$
Year ¾ **Multiply 2digit by 1 digit** Presumes good times table knowledge (allow children with weaker knowledge to use TT		**Drawings of dienes/counter representations from 'concrete'** **Drawing of arrays** **Partitioning (in multiple ways)** **10x5 10x5 10x5 4x5** **30x5 4x5**	

grid to remove that element from learning the methods)			
Year 4 multiply 3digit by 1 digit		**Partitioning and arrays (as above)** 153 × 7 = 1,071 3 × 7 = 21 50 × 7 = 350 100 × 7 = 700 	 Use expanded method, as above, where needed to develop understanding of method. Initially limit the number of exchanges needed, building up to more complex problems with more exchanges.

<table>
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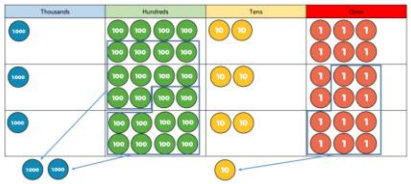
<td>Year 5
4digit by 1 digit</td>
<td>  </td>
<td>Partitioning as above

Written representation of counters.</td>
<td>
<table>
<tr><td></td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>1</td><td>8</td><td>2</td><td>6</td></tr>
<tr><td>×</td><td></td><td></td><td></td><td>3</td></tr>
<tr><td></td><td>5</td><td>4</td><td>7</td><td>8</td></tr>
<tr><td></td><td>2</td><td></td><td>1</td><td></td></tr>
</table>
Use expanded method, as above, where needed to develop understanding of method.

Initially limit the number of exchanges needed, building up to more complex problems with more exchanges.
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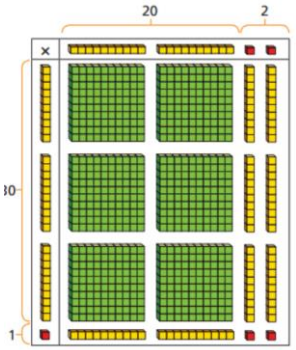
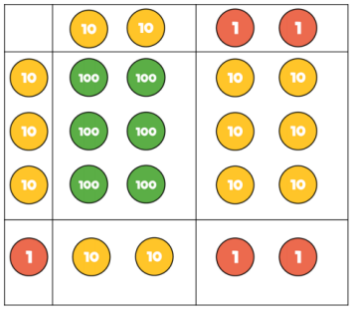
<tr>
<td>Year 5
2digitx2digit</td>
<td> 

 </td>
<td>
<table>
<tr><td>×</td><td>20</td><td>2</td></tr>
<tr><td>30</td><td>600</td><td>60</td></tr>
<tr><td>1</td><td>20</td><td>2</td></tr>
</table>
Drawn representations of concrete examples.
</td>
<td>
<table>
<tr><td></td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td></td><td>2</td><td>2</td></tr>
<tr><td>×</td><td></td><td>3</td><td>1</td></tr>
<tr><td></td><td></td><td>2</td><td>2</td></tr>
<tr><td></td><td>6</td><td>6</td><td>0</td></tr>
<tr><td></td><td>6</td><td>8</td><td>2</td></tr>
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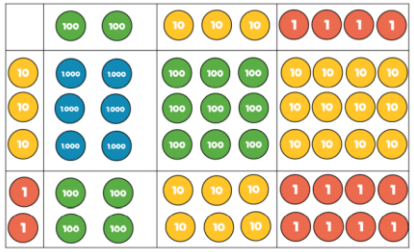
<table>
<tr>
<td>Year 5
3digit x 2 digit</td>
<td>  </td>
<td>
<table>
<tr><td>×</td><td>200</td><td>30</td><td>4</td></tr>
<tr><td>30</td><td>6,000</td><td>900</td><td>120</td></tr>
<tr><td>2</td><td>400</td><td>60</td><td>8</td></tr>
</table>
</td>
<td>
<table>
<tr><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>×</td><td></td><td>3</td><td>2</td></tr>
<tr><td></td><td>4</td><td>6</td><td>8</td></tr>
<tr><td>1 7</td><td>1 0</td><td>2</td><td>0</td></tr>
<tr><td>7</td><td>4</td><td>8</td><td>8</td></tr>
</table>
Always model links between the methods. Show how they are the same.
</td>
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<tr>
<td>Year 5/6
Multiplying 4digits by 2 digits</td>
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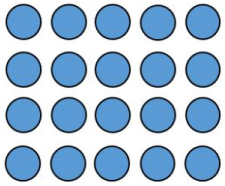
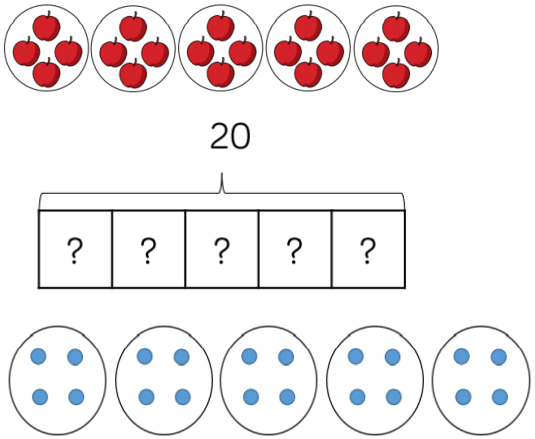
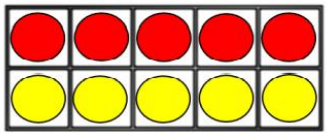
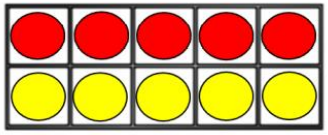
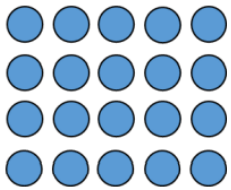
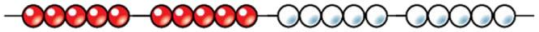
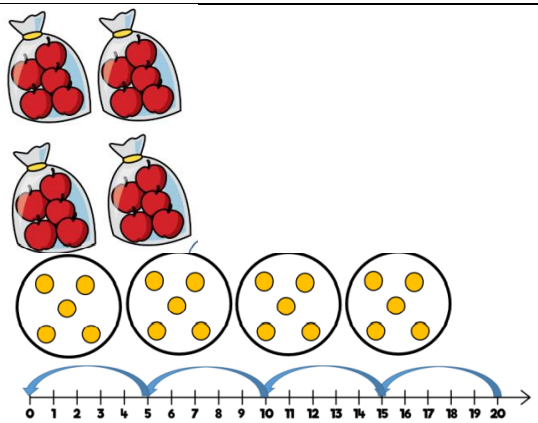
<td></td>
<td>
<table>
<tr><td>TTh</td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td></td><td>2</td><td>7</td><td>3</td><td>9</td></tr>
<tr><td>×</td><td></td><td></td><td>2</td><td>8</td></tr>
<tr><td>2 2</td><td>1 5</td><td>9 3</td><td>1 7</td><td>2</td></tr>
<tr><td>5 1</td><td>4</td><td>7 1</td><td>8</td><td>0</td></tr>
<tr><td>7</td><td>6</td><td>6</td><td>9</td><td>2</td></tr>
<tr><td></td><td></td><td>1</td><td></td><td></td></tr>
</table>
</td>
</tr>
</table>

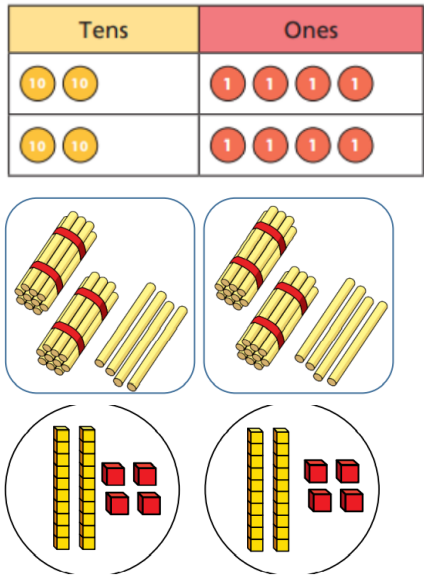
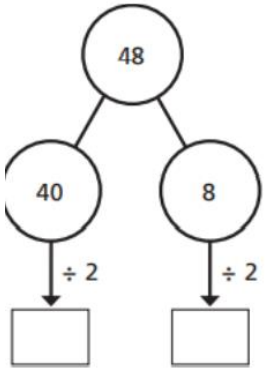
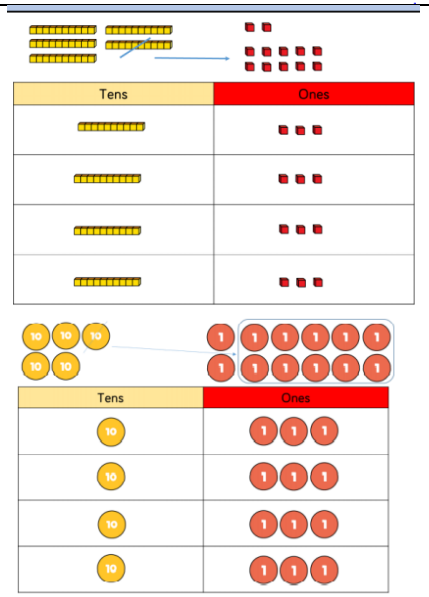
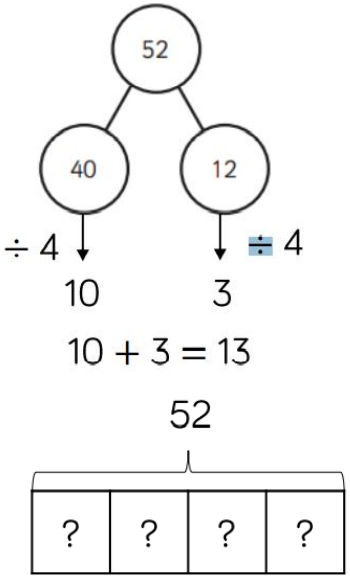
Division

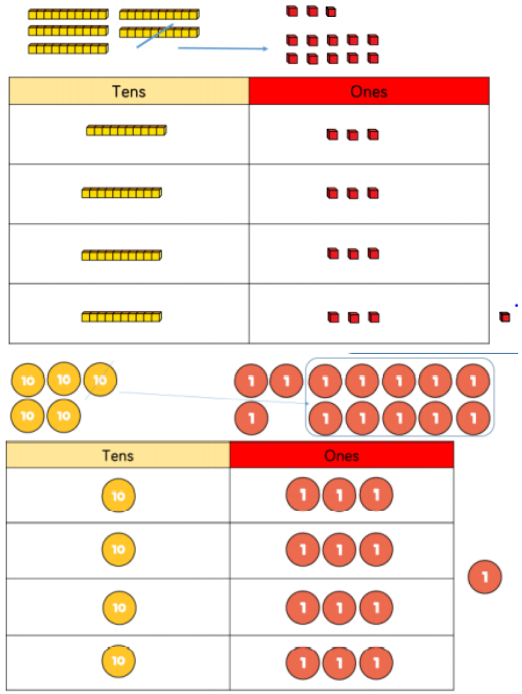
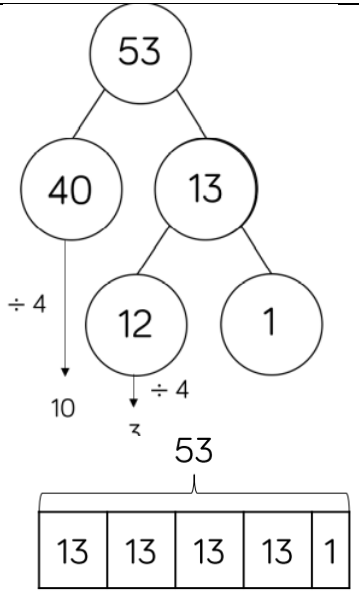
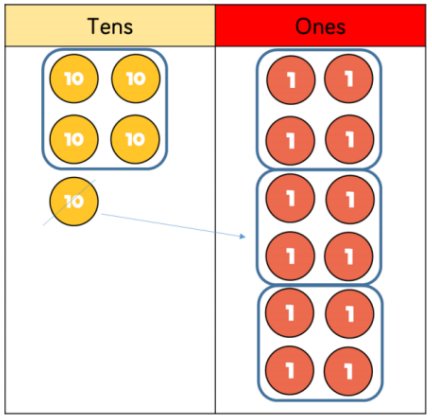
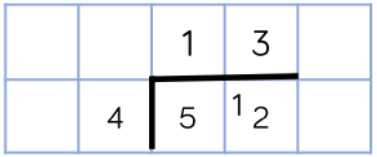
Key points

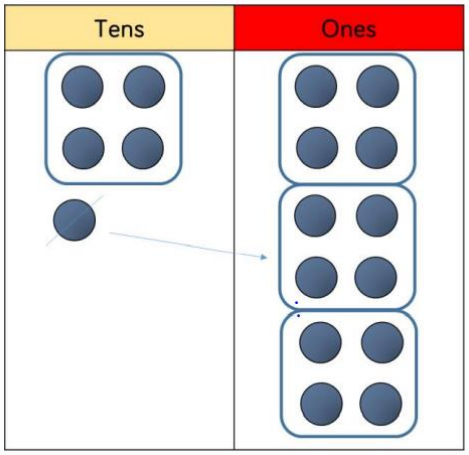
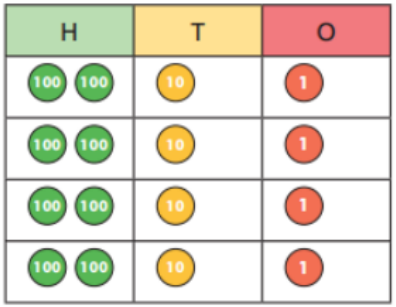
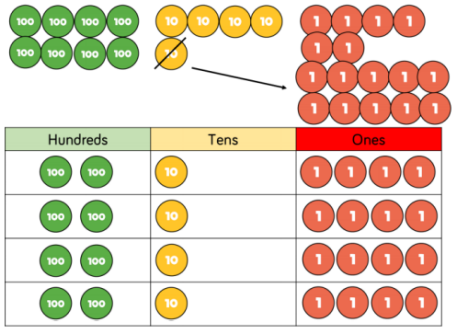
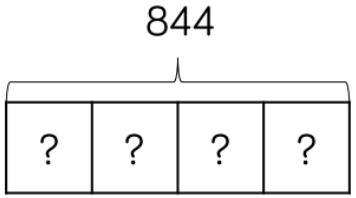
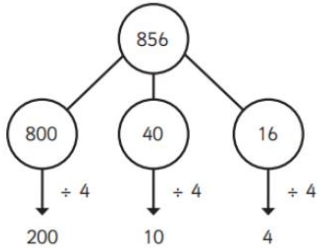
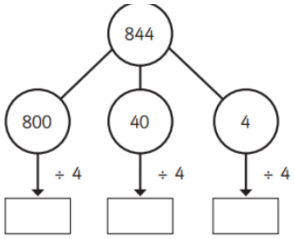
- Continued distinction between grouping and sharing
- Use models, manipulatives and pictures to build understanding

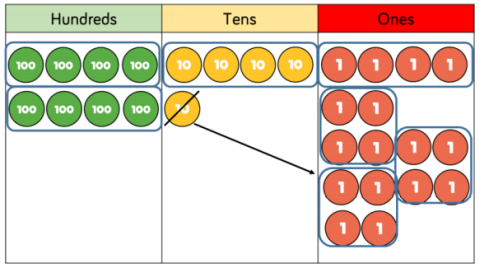
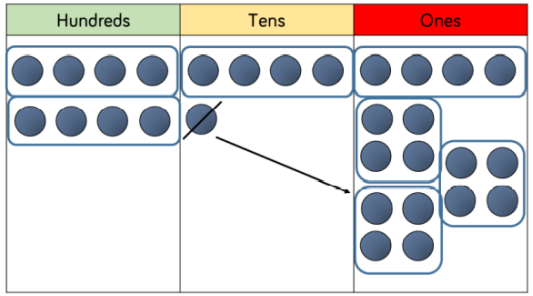
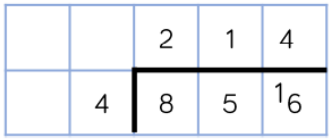
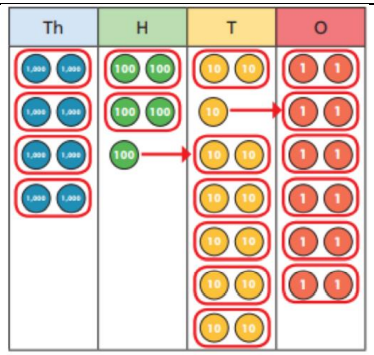
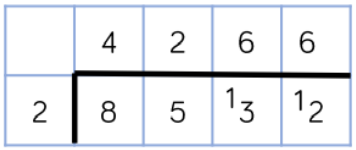
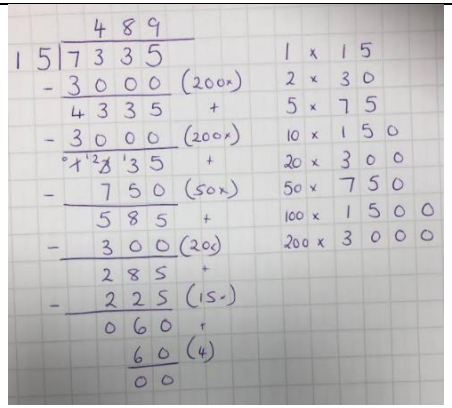
	Concrete	**Pictorial**	**Abstract**

Year 2 Single step problem using multiplication (sharing)			There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag? $20 \div 5 = 4$
Year 2 Solve one step problems using division (grouping)	    		There are 20 apples altogether. They are put in bags of 5. How many bags are there? $20 \div 5 = 4$

Year 2 Divide 2digit by 1digit (sharing with no grouping)			$48 \div 2 = 24$
Year ¾ Dividing 2 digits by 1 digit (sharing with exchange)			$52 \div 4 = 13$

Year ¾ 2digits by 1digit (sharing with remainders)			$53 \div 4 = 13\ r1$
Year 4/5 Divid 2d by 1digit (grouping)			 **Language is very important here 'How many groups of 4 tens can we make?' 'How many groups of 4 ones can we make?'**

			
Year 4 3digits by 1 digit (sharing)	 	  	$844 \div 4 = 122$

Year 5 3 Digits by 1 digit (grouping)	 	Drawing representation of counters.	
Year 5 4digits by 1 digit (grouping)		Drawing counters for representation.	
Year 6 Divide multiple digits by 2 digits (long division)			

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<tr>
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<table>
<tr><td></td><td></td><td>0</td><td>3</td><td>6</td></tr>
<tr><td>1</td><td>2</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td></td><td>–</td><td>3</td><td>6</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td>7</td><td>2</td></tr>
<tr><td></td><td>–</td><td></td><td>7</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td><td>0</td></tr>
</table>
(×30)
(×6)
12 × 1 = 12
12 × 2 = 24
12 × 3 = 36
12 × 4 = 48
12 × 5 = 60
12 × 6 = 72
12 × 7 = 84
12 × 8 = 96
12 × 7 = 108
12 × 10 = 120
7,335 ÷ 15 = 489
<table>
<tr><td></td><td>0</td><td>4</td><td>8</td><td>9</td></tr>
<tr><td>15</td><td>7</td><td>3</td><td>3</td><td>5</td></tr>
<tr><td>–</td><td>6</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td></td><td>1</td><td>3</td><td>3</td><td>5</td></tr>
<tr><td>–</td><td>1</td><td>2</td><td>0</td><td>0</td></tr>
<tr><td></td><td></td><td>1</td><td>3</td><td>5</td></tr>
<tr><td>–</td><td></td><td>1</td><td>3</td><td>5</td></tr>
<tr><td></td><td></td><td></td><td></td><td>0</td></tr>
</table>
(×400
(×80)
(×9)
1 × 15 = 15
2 × 15 = 30
3 × 15 = 45
4 × 15 = 60
5 × 15 = 75
10 × 15 = 150
</td>
</tr>
<tr>
<td>Year 6
Divide multiple digits by 2 digits (short division)</td>
<td></td>
<td>
<table>
<tr><td>15</td><td>30</td><td>45</td><td>60</td><td>75</td><td>90</td><td>105</td><td>120</td><td>135</td><td>150</td></tr>
</table>
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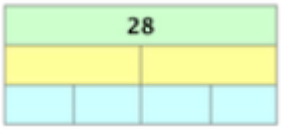
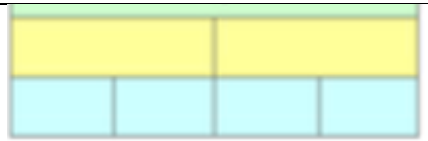
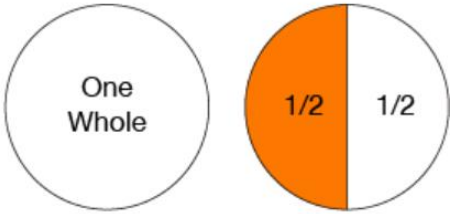
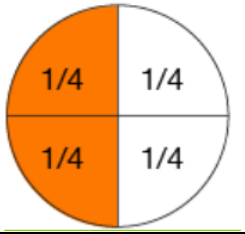
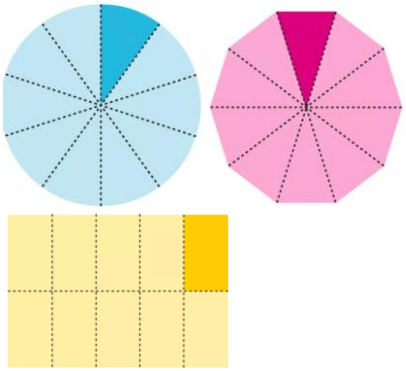
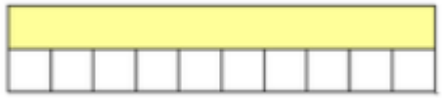
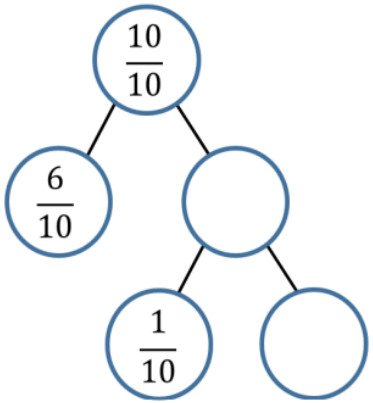
<table>
<tr><td></td><td></td><td>0</td><td>3</td><td>6</td></tr>
<tr><td></td><td>12</td><td>4</td><td>$^{4}3$</td><td>$^{7}2$</td></tr>
</table>
432 ÷ 12 = 36
7,335 ÷ 15 = 489
<table>
<tr><td></td><td>0</td><td>4</td><td>8</td><td>9</td></tr>
<tr><td>15</td><td>7</td><td>$^{7}3$</td><td>$^{13}3$</td><td>$^{13}5$</td></tr>
</table>
Write out multiplication facts to support.
</td>
</tr>
</table>

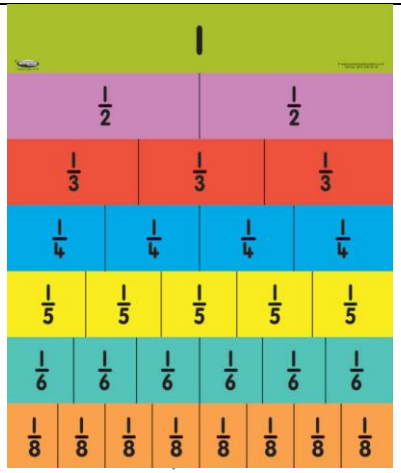
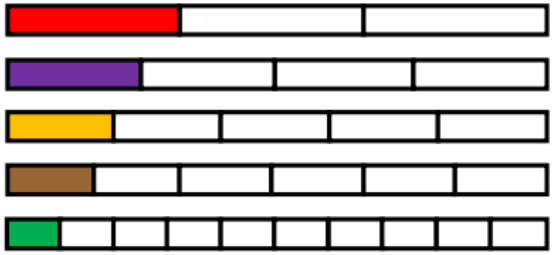
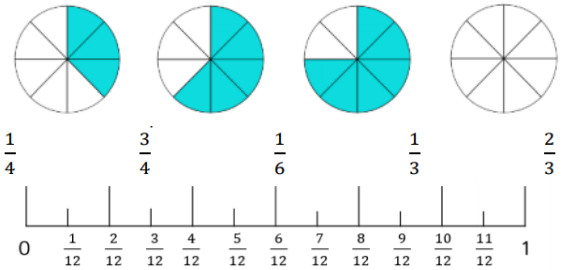
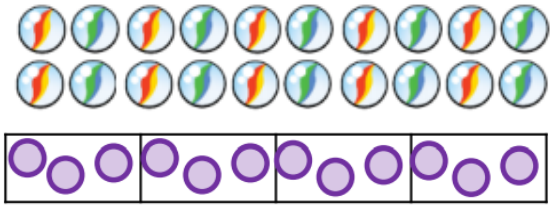
Fractions

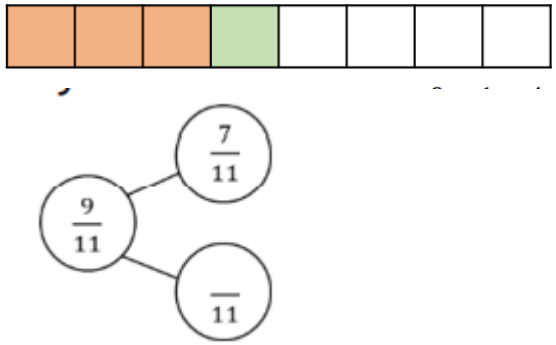
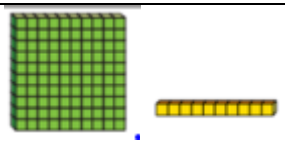
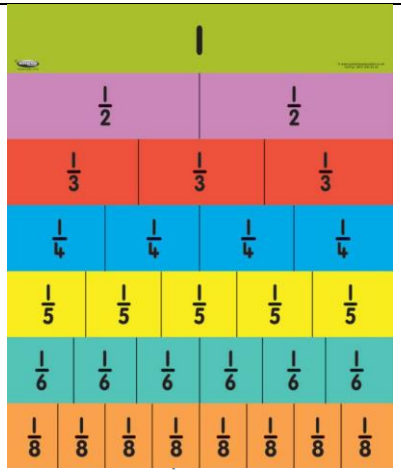
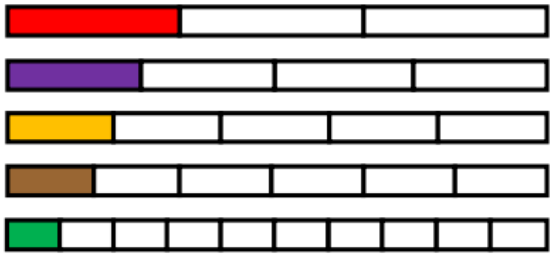
Key points

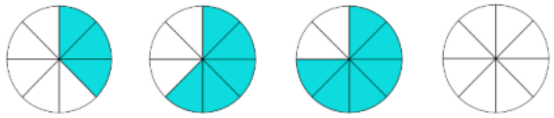
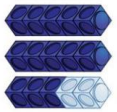
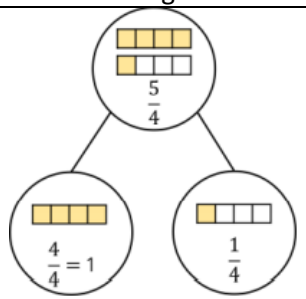
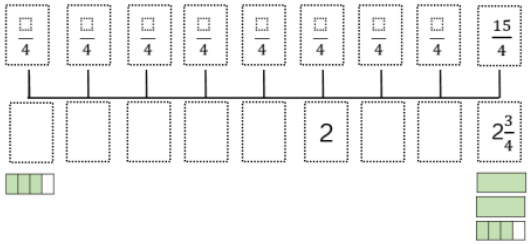
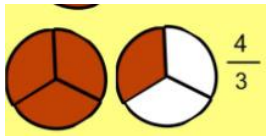
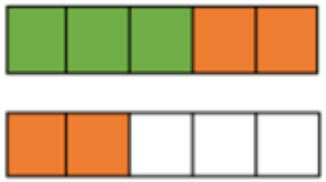
- Ensure lots of exposure to concrete and pictorial models
- Use accurate fractions vocabulary

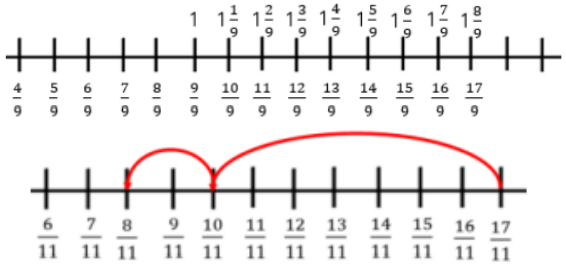
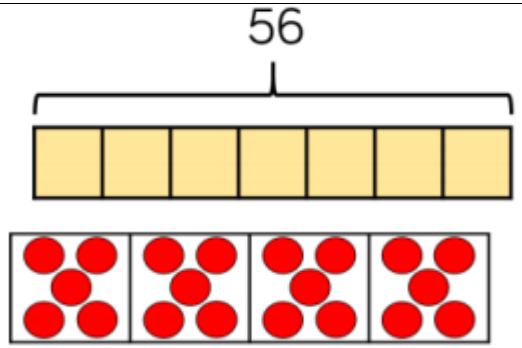
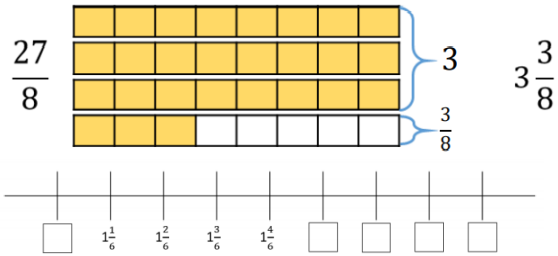
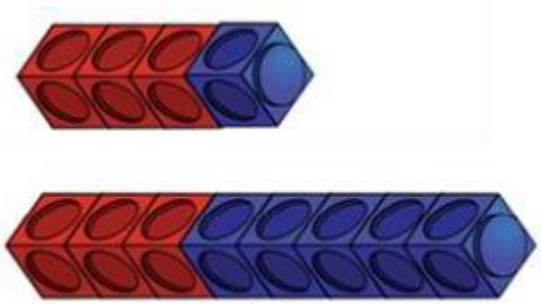
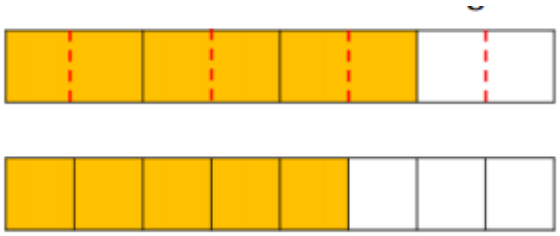
	Concrete	**Pictorial**	**Abstract**
Year 2/Prior Learning Recognise, write and name 1/3, ½, ¼, 2/4 and ¾ of a length, shape or quantity	Cutting shapes Finding fractions of physical objects e.g. counters, multilink etc.	 	e.g. ½ of 28 = 14 (divide by 2) ¼ of 28 = 7 (divide by 4)
Year 2 Recognise the equivalence of 2/4 =1/2	Cutting/folding and comparing	  	Recognising the relationship between denominators and numerators of ½ and 2/4
Year 3 Recognising	Cutting shapes/strips into 10 equal parts.	Counting stick in tenths	10/10 = 1 / = divide

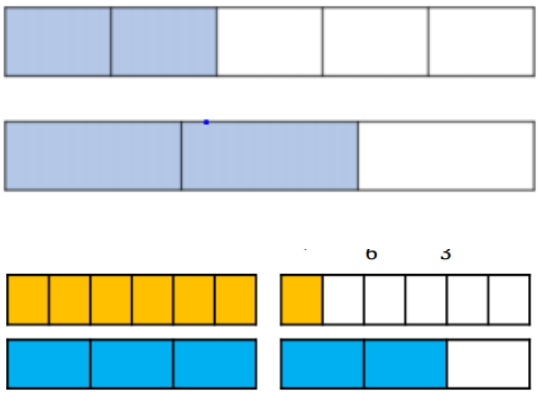
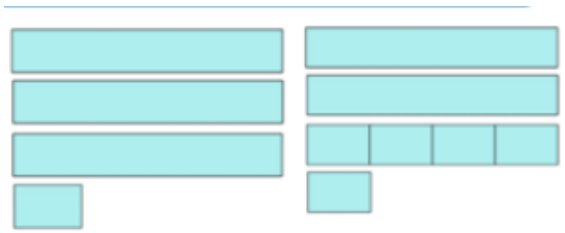
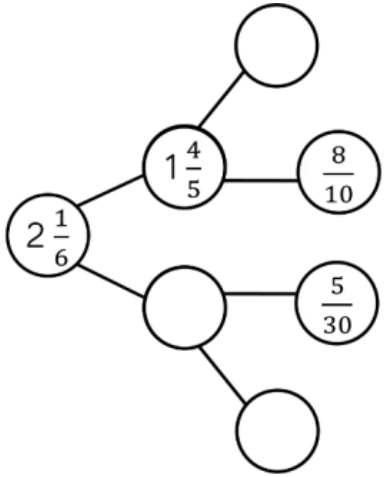
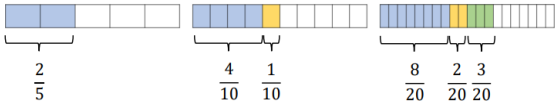
tenths	Finding 10ths of amounts physically Use a bead string  Dienes 	 Different pictorial representations of tenths.  Bar model  Partitioning  	Recognise tenths as decimals

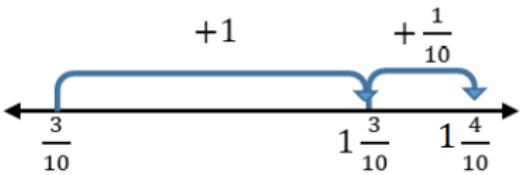
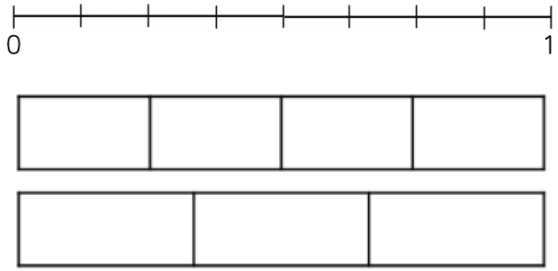
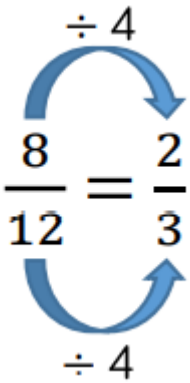
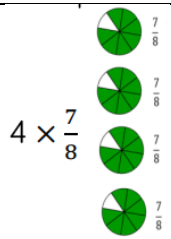
Year 3 Equivalent Fractions with small denominators Comparing and ordering	Make a fraction wall Look at what is the same Make different fractions What's the same/different?	  	Recognise relationships between numerators and denominators in equivalent fractions
Year 3 Find fractions of an amount (unit and non-unit with small denominators)	Find ½, ¼, ¾, 1/3 and 2/3 of objects Use counters to 'share' 	Pictures of objects  Pictures in different contexts **e.g. volume, time, length**	Make connections between multiplication and division to find fractions of a set of objects e.g. ¼ of 24=6 24/4=6 ¾ of 24 = 18 because ¼ = 6 (and 6x3=18)

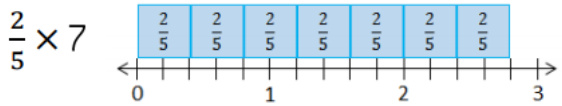
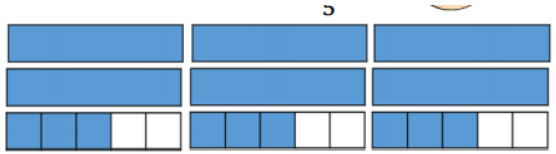
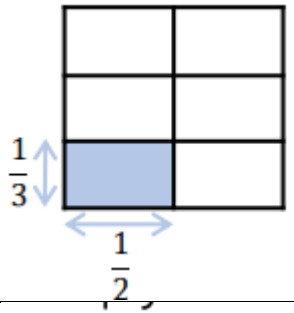
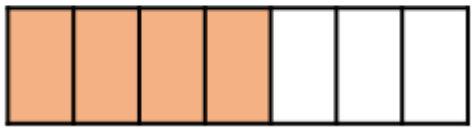
Year 3 Add and subtract within a whole	Cuisainare rods Multilink Paper parts		Recognising numerators are added where denominator is the same
Year 4 Hundredths and tenths	 Recognising the relationship between hundredths, 10s and 1s 	As year 3 'recognising 10ths' but with hundredths representations also Place value representation to start showing links between decimals and fractions.	Recognsing links between tenths and hundredth and decimals.
Year 4 Equivalent fractions (not just small denominators) Comparing and ordering	Use paper to represent equivalent fractions. Cutting/folding Cuisenaire rods Build fraction wall	 	$\frac{1}{3} = \frac{\square}{6} = \frac{\square}{12} = \frac{\square}{24}$ Links with Multiplication and Division

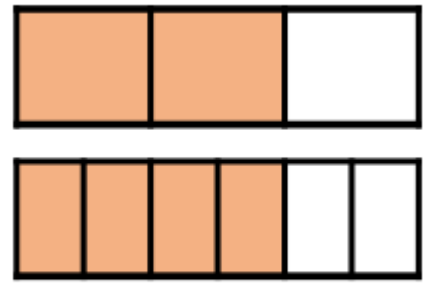
		 Number line Bar modelling	
Year 4 Fractions more than 1	 Make wholes and fractions with physical things to explore fractions more than 1. e.g. Paper cutting, Cuisanaire, dienes for tenths and hundredths	   Bar Models	Written representation Link with multiplication and division – improper to mixed number and vice versa
Add and subtract with same denominator	Use physical representations where needed (as y3)	 3/5+4/5 =  $\frac{2}{7}+\frac{2}{7}$  $\frac{6}{7}-\frac{2}{7}=$	Recognising denominators, converting between mixed/improper to calculate effectively

		Number Lines 	
Year 4 Fraction of amounts	As year 3 where necessary		Application of times table and division knowledge to find unit and non-unit fractions of amounts (where the amount is a multiple of the denominator) $\frac{1}{7}$ of 56 = 56 ÷ $\square$
Year 5 Improper fractions and mixed numbers	As year 4 (fractions more than 1)		Improper fractions as division. Fraction remainders. e.g. 27/8 = 3 r 3 (3 3/8)
Year 5 Compare and order where denominators and multiples of each other	As year 4 where needed 		Finding common denominators Use simplification to compare Explore relationships between denominators to find equivalence to compare.

	Comparing eigths and quarters		
Year 5 Adding and subtracting fractions	As Year 4 but with adding 2 or more fractions with the same denominator and going over 1 Add fractions with different denominators by finding common denominators first	As Year 4 but with adding 2 or more fractions with the same denominator and going over 1   	Use mathematical strategies to add and subtract fractions with different denominators, including mixed numbers

			
Year 6 Comparing and ordering	As previous years where concrete representation is required to embed learning		Finding lowest common denominator to compare and order e.g. Multiples of 6: 6, 12, 18, 24 Multiples of 4: 4, 8, 12, 16, 12 is the LCM of 4 and 6
Year 6 Simplifying fractions			
Year 6 Add and subtract fractions including mixed numbers	As Year 5	As Year 5	As Year 5
Year 6 Multiplying fractions			Multiply the whole, then multiply the fractions (add together)

		  $2\frac{3}{5} \times 3$  Partitioning Multiply the whole, then multiply the fractions (add together) Multiplying fractions by fractions 	Fractions x fractions Multiply numerators, denominators, simplify.
Year 6 Dividing fractions		$\frac{4}{7} \div 4 =$ 	Dividing by whole numbers: Numerator, divided by whole, expressed as a fraction of the numerator

		2/3 ÷ 4 Find lowest common multiple for numerator. Divide by whole.  $\frac{2}{3} = \frac{4}{6}$ $\frac{4}{6} \div 4 = \frac{1}{6}$	Find lowest common multiple for numerator. Divide by whole.