



WORK HARD • BE KIND • HAVE COURAGE  
*The Barton Hill Way*

# Barton Hill Academy Calculation Policy



## **How should this policy be used?**

This policy has been designed to support the teaching and planning of mathematics in our school. The policy only details the strategies, and teachers must plan opportunities for pupils to apply these; for example, when solving problems, or where opportunities emerge elsewhere in the curriculum. The examples and illustrations are not exhaustive but provide an overall picture of what the mathematics in our school should look like. This is not a scheme of work and must be used in conjunction with our school maths and curriculum documents.

This policy sets out the progression of strategies and written methods which children will be taught as they develop in their understanding of the four operations. Strategies are set out in a Concrete, Pictorial, Abstract (CPA) approach to develop children's deep understanding and mastery of mathematical concepts. Children use concrete objects to help them make sense of the concept or problem; this could be anything from real or plastic fruit, to straws, counters or cubes. This is then developed through the use of images, models and children's own pictorial representations before moving on to the abstract mathematics. Children will travel along this continuum again and again, often revisiting previous stages when a concept is extended. It is also worth noting that if a child has moved on from the concrete to the pictorial, it does not mean that the concrete cannot be used alongside the pictorial. Or if a child is working in the abstract, 'proving' something or 'working out' could involve use of the concrete or pictorial.

Similarly, although the strategies are taught in a progressive sequence, they are designed to equip children with a 'tool box' of skills and strategies that they can apply to solve problems in a range of contexts. So as a new strategy is taught it does not necessarily supersede the previous, but builds on prior learning to enable children to have a variety of tools to select from. As children become increasingly independent, they will be able to and must be encouraged to select those strategies which are most efficient for the task.

The strategies are separated into the 4 operations for ease of reference. However, it is intended that addition and subtraction, and multiplication and division will be taught together to ensure that children are making connections and seeing relationships in their mathematics. Therefore, some strategies will be taught simultaneously, for example, counting on (addition) and counting back (subtraction).

Children should be moved through the strategies at a pace appropriate to their age-related expectations as defined in the EYFS and NC. Effective teaching of the strategies rely on increasing levels of number sense, fluency and ability to reason mathematically. Children must be supported to gain depth of understanding within the strategy through the CPA approach and not learn strategies as a procedure.


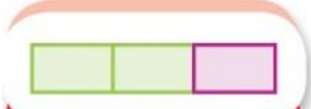
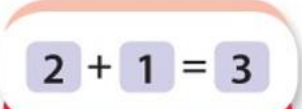
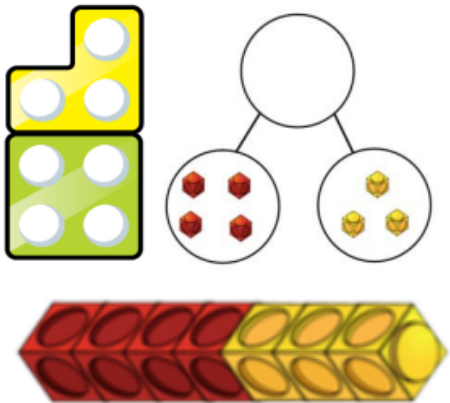
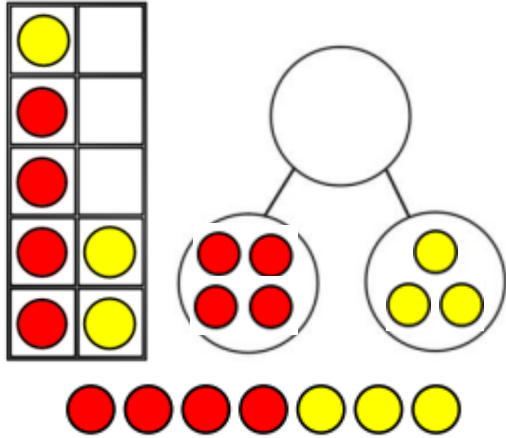
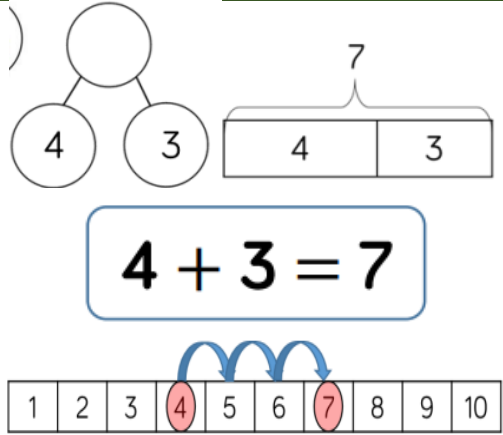
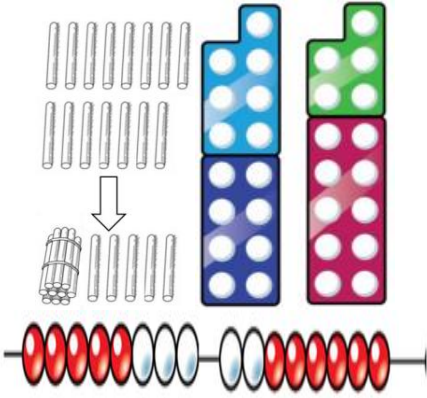
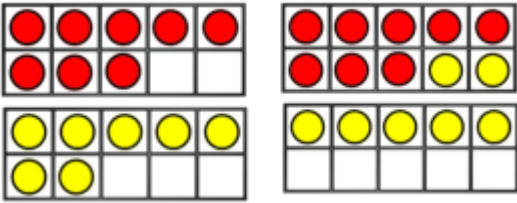
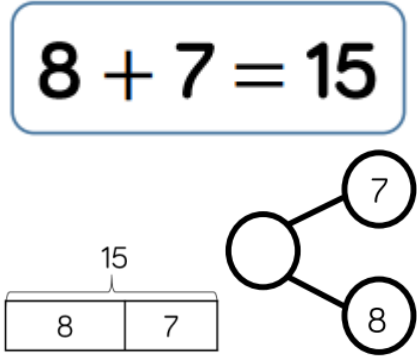
## End of year expectations for Calculations

	Nursey	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition & Subtraction		<p><b>ONE MORE &amp; ONE LESS</b> – Predict how many there will be if we add one more or take one away</p> <p>Notice the link between counting forwards the one more pattern and counting back and the one less pattern.</p> <p><b>COMBINING 2 GROUPS</b> - Combine 2 groups to find out how many altogether.</p> <p><b>ADDING MORE</b> – Use real objects to see that the quantity of a group can be changed by adding more and represent these numbers.</p> <p><b>TAKING AWAY</b> – Use real objects to see that the quantity of a group can be changed by taking items away.</p>	Add and subtract one-digit and two-digit numbers to 20, including zero.	Add and subtract numbers using concrete objects, pictorial representations, and mentally including: <ul style="list-style-type: none"> <li>- a two-digit number and ones.</li> <li>- a two-digit number and tens.</li> <li>- two two-digit numbers.</li> <li>- adding three one-digit numbers.</li> </ul>	Add and subtract numbers mentally including: <ul style="list-style-type: none"> <li>- a three-digit number and ones.</li> <li>- a three-digit number and tens.</li> <li>- a three digit numbers and hundreds.</li> </ul> <p>Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction.</p>	Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate.	Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction).	Perform mental calculations, including with mixed operations and large numbers.
Multiplication & Division: Calculations		<p><b>SHARING &amp; GROUPING</b> – Share items equally and notice when items are not shared fairly</p> <p>Recognise and make equal groups.</p> <p>Notice that sometimes there may be items left over when we share or group and find ways to resolve this.</p>		Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs.	Write and calculate mathematical statements for multiplication and 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.	Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.	<p>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.</p> <p>Multiply and divide numbers mentally drawing upon known facts.</p> <p>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.</p> <p>Multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000.</p>	<p>Multiply multi-digit numbers up to 4 digit s by a two-digit whole number using the formal written method of long multiplication.</p> <p>Divide numbers up to 4 digit 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.</p> <p>Divide numbers up to 4 digit by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context.</p> <p>Perform mental calculations, including with mixed operations and large numbers.</p>

## Progression in Calculations

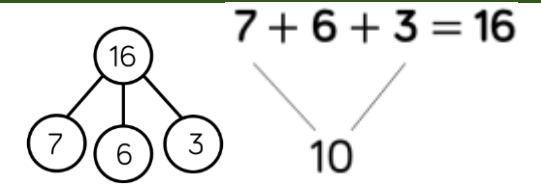
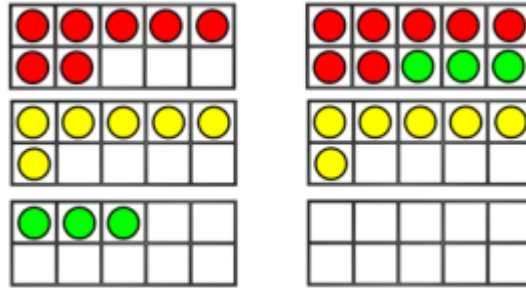
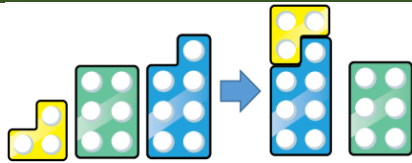
# Addition

Key Language – sum, total, parts and wholes, plus, add, altogether, more, 'is equal to' 'is the same as'.

Skill	Year	 <p style="text-align: center; color: white; background-color: red; padding: 5px;"><b>CONCRETE</b></p>	 <p style="text-align: center; color: white; background-color: red; padding: 5px;"><b>PICTORIAL</b></p>	 <p style="text-align: center; color: white; background-color: red; padding: 5px;"><b>ABSTRACT</b></p>
Add two 1-digit numbers to 10	<b>1</b>			
Add 1 and 2-digit numbers to 20	<b>1</b>			

Add three 1-digit numbers

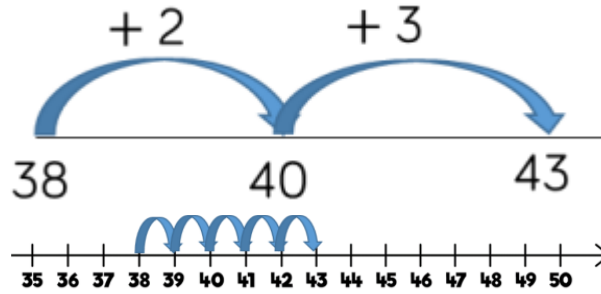
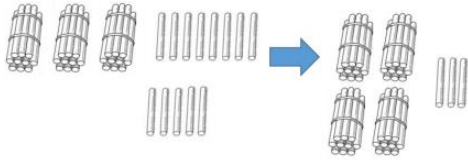
2



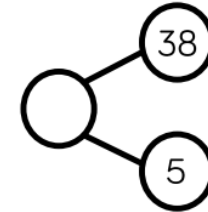
$$7 + 6 + 3 = 16$$

Add 1 and 2-digit numbers to 100

2

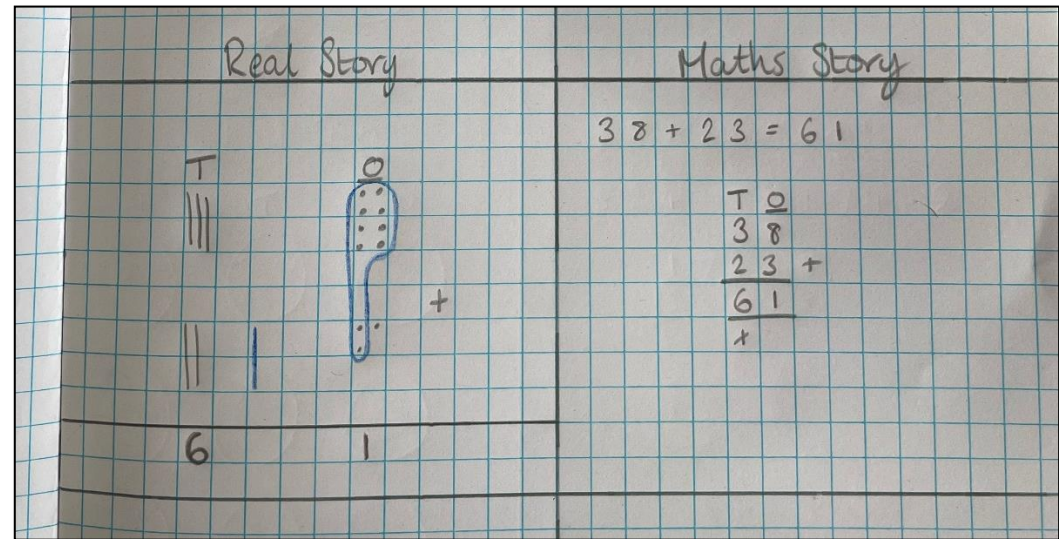
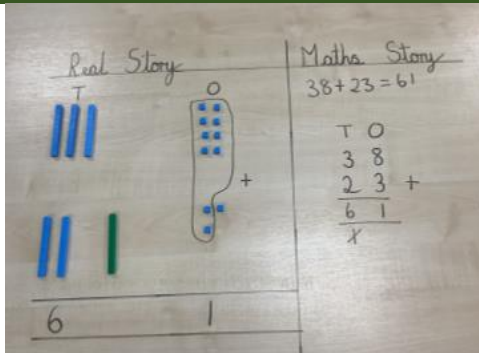


$$38 + 5 = 43$$



Add two 2-digit numbers

2



Add with up to 3-digits

3

**Real Story**

**Maths Story**

$$241 + 168 = 409$$

H	T	O
2	4	1
1	6	8
+		
4	0	9

**Real Story**

**Maths Story**

$$241 + 168 = 409$$

H	T	O
2	4	1
1	6	8
+		
4	0	9

Add with up to 4-digits

4

**Real Story**

**Maths Story**

$$1251 + 1362 = 2613$$

Th	H	T	O
1	2	5	1
1	3	6	2
+			
2	6	1	3

**Real Story**

**Maths Story**

$$1251 + 1362 = 2613$$

Th	H	T	O
1	2	5	1
1	3	6	2
+			
2	6	1	3

Add with  
more than  
4-digits

5/6

Add with  
up to 3  
decimal  
places

5/6

Real Story	Maths Story
	$63754 + 9238$ $= 72992$
	$\begin{array}{r} 63754 \\ 9238 \\ \hline 72992 \\ \times \quad \times \end{array}$
	$4.3 \text{ m} + 17.8 \text{ m}$ $= 22.1 \text{ m}$
	$\begin{array}{r} 4.3 \\ 17.8 \\ \hline 22.1 \\ \times \quad \times \end{array}$

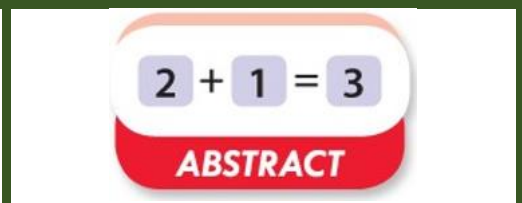
### Progression in Calculations

## Subtraction

Key Language – take away, less than, the difference, subtract, minus, fewer, decrease.

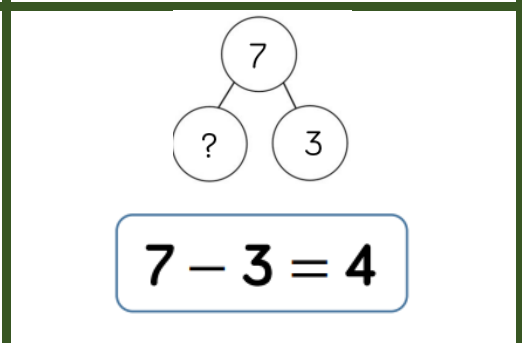
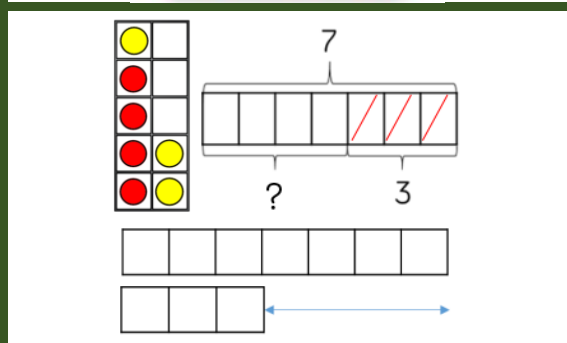
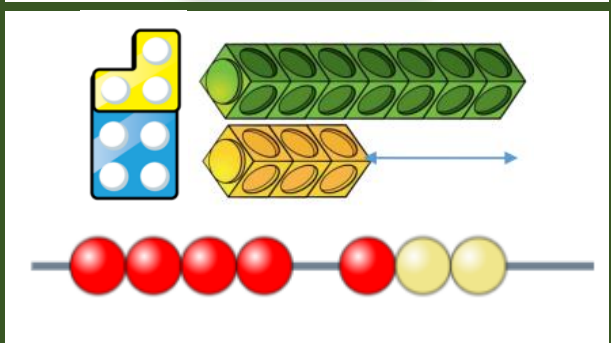
Skill

Year



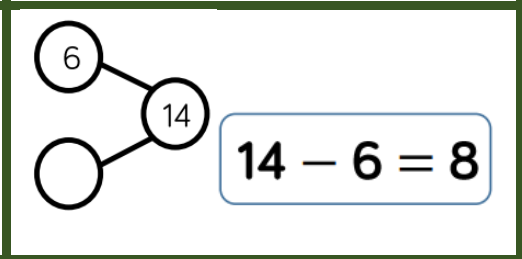
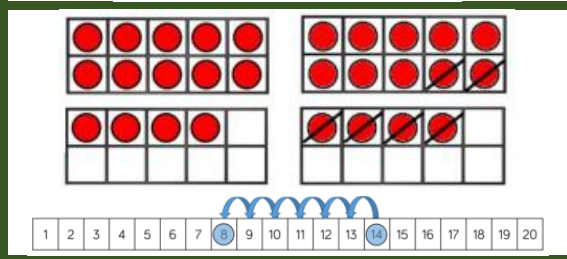
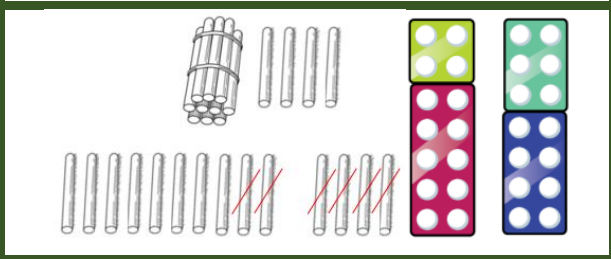
Subtract two 1-digit numbers

1



Subtract 1 and 2-digit numbers to 20

1





Subtract 1 and 2-digit numbers to 100

2

Real Story	Maths Story
	$65 - 8 = 57$ $\begin{array}{r} \text{T} \quad \text{O} \\ 6 \quad 5 \\ \underline{\quad 8} \\ \hline \end{array}$


Real Story	Maths Story
	$65 - 8 =$ $\begin{array}{r} \text{T} \quad \text{O} \\ 5 \cancel{\times} 15 \\ \underline{\quad 8} \\ \hline \end{array}$

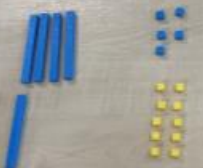
Real Story	Maths Story
	$65 - 8 =$ $\begin{array}{r} \text{T} \quad \text{O} \\ 5 \cancel{\times} 15 \\ \underline{\quad 8} \\ \hline \end{array}$


Real Story	Maths Story
	$65 - 8 = 57$ $\begin{array}{r} \text{T} \quad \text{O} \\ 5 \cancel{\times} 15 \\ \underline{\quad 8} \\ \hline 57 \end{array}$

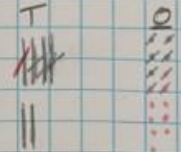
Subtract two  
2-digit  
numbers

2

Real Story	Maths Story
	$\begin{array}{r} 65 - 28 = 37 \\ \text{T} \quad \text{O} \\ 6 \quad 5 \\ \underline{2 \quad 8} \\ \hline \end{array}$

Real Story	Maths Story
	$\begin{array}{r} 65 - 28 = 37 \\ \text{T} \quad \text{O} \\ 5 \cancel{6} \quad 15 \\ \underline{2 \quad 8} \\ \hline \end{array}$

Real Story	Maths Story
	$\begin{array}{r} 65 - 28 = 37 \\ \text{T} \quad \text{O} \\ 5 \cancel{6} \quad 15 \\ \underline{2 \quad 8} \\ \hline 3 \quad 7 \end{array}$

Real Story	Maths Story
	$\begin{array}{r} 65 - 28 = 27 \\ \text{T} \quad \text{O} \\ 5 \cancel{6} \quad 15 \\ \underline{2 \quad 8} \\ \hline 2 \quad 7 \end{array}$

Subtract with up to 3-digits

3

Real Story			Maths Story												
H	T	O													
			$431 - 291 =$												
			<table border="1"> <thead> <tr> <th>H</th> <th>T</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>3</td> <td>1</td> </tr> <tr> <td>2</td> <td>9</td> <td>1</td> </tr> <tr> <td colspan="3"><hr/></td> </tr> </tbody> </table>	H	T	O	4	3	1	2	9	1	<hr/>		
H	T	O													
4	3	1													
2	9	1													
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Real Story			Maths Story												
H	T	O													
			$431 - 291 =$												
			<table border="1"> <thead> <tr> <th>H</th> <th>T</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>4</td> <td>1</td> </tr> <tr> <td>2</td> <td>9</td> <td>1</td> </tr> <tr> <td colspan="3"><hr/></td> </tr> </tbody> </table>	H	T	O	3	4	1	2	9	1	<hr/>		
H	T	O													
3	4	1													
2	9	1													
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Real Story			Maths Story															
H	T	O																
			$431 - 291 = 140$															
			<table border="1"> <thead> <tr> <th>H</th> <th>T</th> <th>O</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>4</td> <td>1</td> </tr> <tr> <td>2</td> <td>9</td> <td>1</td> </tr> <tr> <td colspan="3"><hr/></td> </tr> <tr> <td>1</td> <td>4</td> <td>0</td> </tr> </tbody> </table>	H	T	O	3	4	1	2	9	1	<hr/>			1	4	0
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3	4	1																
2	9	1																
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1	4	0																

Real Story			Maths Story															
H	T	O																
			$431 - 291 = 140$															
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H	T	O																
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2	9	1																
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1	4	0																

Subtract with up to 4-digits

4

**Real Story**

**Maths Story**  
 $4365 - 1823 =$

Th	H	T	O
4	3	6	5
1	8	2	3
<hr/>			

**Real Story**

**Maths Story**  
 $4365 - 1823 =$

Th	H	T	O
4	3	6	5
1	8	2	3
<hr/>			

**Real Story**

**Maths Story**  
 $4365 - 1823 = 2542$

Th	H	T	O
4	3	6	5
1	8	2	3
<hr/>			
2	5	4	2

**Real Story**

**Maths Story**  
 $4365 - 1823 = 2542$

Th	H	T	O
<del>4</del>	<del>3</del>	<del>6</del>	<del>5</del>
<del>1</del>	<del>8</del>	<del>2</del>	<del>3</del>
<hr/>			
2	5	4	2

Subtract with more than 4-digits

5/6

Subtract with  
up to 3  
decimal places

5/6

Real Story

Maths Story

$$63412 - 43674$$

$$= 19738$$

$$\begin{array}{r} \overset{5}{6} \overset{1}{3} \overset{2}{4} \overset{1}{2} \\ 63412 \\ - 43674 \\ \hline 19738 \end{array}$$

$$18.431 - 6.91$$

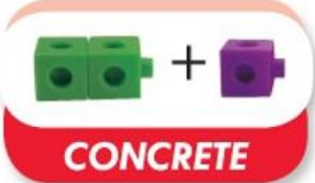

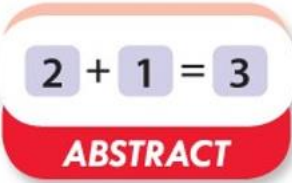
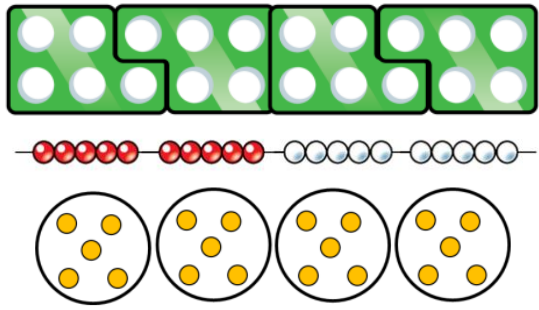
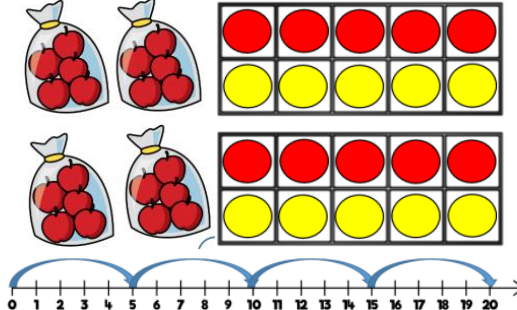
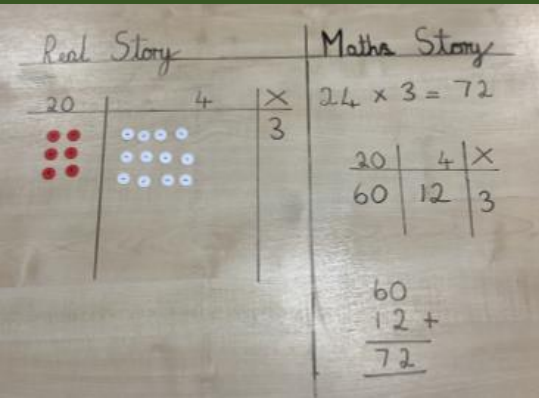
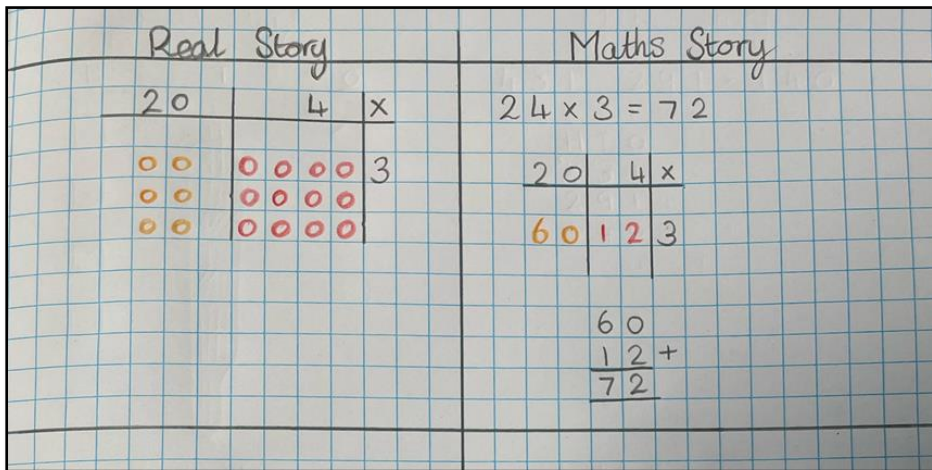
$$= 11.531$$

$$\begin{array}{r} 18.43 \\ - 6.91 \\ \hline 11.53 \end{array}$$

## Progression in Calculations

# Multiplication

Key Language – double, times, multiplied by, the product of, groups of, lots of, equal groups.

Skill	Year	 <p style="text-align: center; color: red; font-weight: bold;">CONCRETE</p>	 <p style="text-align: center; color: red; font-weight: bold;">PICTORIAL</p>	 <p style="text-align: center; color: red; font-weight: bold;">ABSTRACT</p>
Solve one-step problems with multiplication	<b>1/2</b>			<div style="border: 1px solid gray; border-radius: 10px; padding: 5px; margin-bottom: 10px;">             One bag holds 5 apples.              How many apples do 4 bags hold?           </div> $5 + 5 + 5 + 5 = 20$ $4 \times 5 = 20$ $5 \times 4 = 20$
Multiply 2-digit by 1-digit numbers	<b>3/4</b>			

**Multiply 3-digit  
by 1-digit  
numbers**

**4**

Real Story				Maths Story			
200	30	6	X	236 × 3 =			
●●●	●●●	●●●●●●	3	200	30	6	X
●●●	●●●	●●●●●●		600	90	18	3
●●●	●●●	●●●●●●					
				600	90	18	
				<u>708</u>			
				x			

Real Story				Maths Story			
200	30	6	X	236 × 3 = 708			
○○○	○○○	○○○	3	200	30	6	X
○○○	○○○	○○○		600	90	18	3
○○○	○○○	○○○					
				HTO			
				600			
				90			
				18 +			
				<u>708</u>			
				x			
				236 × 3 = 708			
				236			
				3 x			
				<u>708</u>			
				x			

**Multiply 4-digit  
by 1-digit  
numbers**







**5**


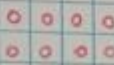

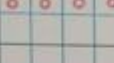

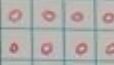
Real Story				Maths Story			
2000	300	20	X	2324 × 3 = 6972			
●●●●	●●●	●●	3	2000	300	20	4 X
●●●●	●●●	●●		6000	900	60	12 3
●●●●	●●●	●●					
				6000	900	60	
				<u>6972</u>			
				12 +			

Real Story				Maths Story			
2000	300	20	X	2324 × 3 = 6972			
○○○○	○○○	○○	3	2000	300	20	4 X
○○○○	○○○	○○		6000	900	60	12 3
○○○○	○○○	○○					
				Th H T O			
				6000			
				900			
				60			
				12 +			
				<u>6972</u>			
				2324 × 3 = 6972			
				Th H T O			
				2324			
				3 x			
				<u>6972</u>			
				x			

**Multiply 2-digit  
by 2-digit  
numbers**

**5**

Real Story			Maths Story		
20	6	X	26	13	= 338
		3	$\begin{array}{r} 20 \\ 60 \\ \hline 200 \end{array}$	$\begin{array}{r} 6 \\ 18 \\ \hline 60 \end{array}$	$\begin{array}{r} 3 \\ 18 \\ \hline 60 \end{array}$
		10	$\begin{array}{r} 200 \\ 60 \\ \hline 260 \end{array}$	$\begin{array}{r} 60 \\ 18 \\ \hline 78 \end{array}$	$\begin{array}{r} 60 \\ 18 \\ \hline 78 \end{array}$
			$\begin{array}{r} \text{HTO} \\ 200 \\ 60 \\ \hline 260 \end{array}$	$\begin{array}{r} \text{TO} \\ 60 \\ 18 \\ \hline 78 \end{array}$	$\begin{array}{r} \text{HTO} \\ 260 \\ 78 \\ \hline 338 \\ \times \end{array}$

Real Story			Maths Story		
20	6	X	26	13	= 338
		3	$\begin{array}{r} 200 \\ 60 \\ \hline 260 \end{array}$	$\begin{array}{r} 60 \\ 18 \\ \hline 78 \end{array}$	$\begin{array}{r} 60 \\ 18 \\ \hline 78 \end{array}$
		10	$\begin{array}{r} 200 \\ 60 \\ \hline 260 \end{array}$	$\begin{array}{r} 60 \\ 18 \\ \hline 78 \end{array}$	$\begin{array}{r} 260 \\ 78 \\ \hline 338 \\ \times \end{array}$
			$\begin{array}{r} \text{HTO} \\ 200 \\ 60 \\ \hline 260 \end{array}$	$\begin{array}{r} \text{TO} \\ 60 \\ 18 \\ \hline 78 \end{array}$	$\begin{array}{r} 260 \\ 78 \\ \hline 338 \\ \times \end{array}$





Multiply 2-digit  
by 4-digit  
numbers

5/6

Real Story

Maths Story




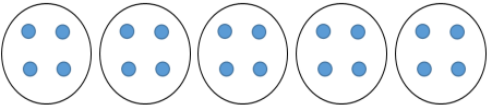
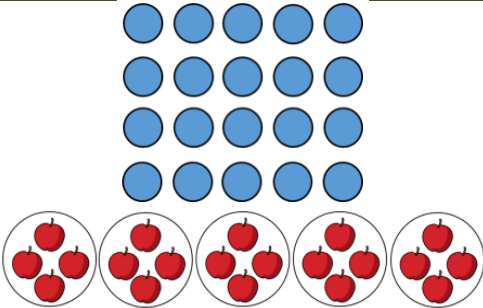
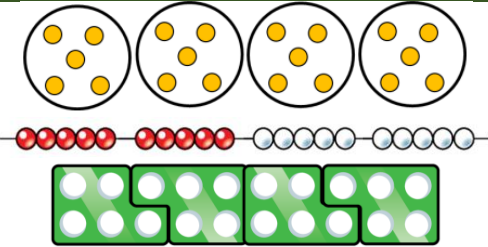
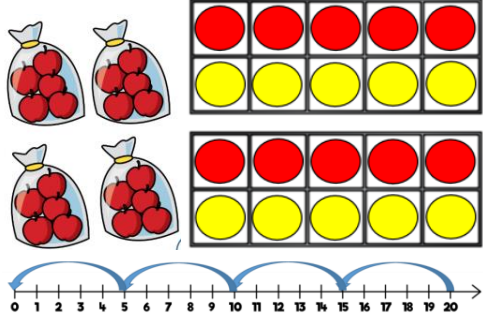
$$3826 \times 24 = 91824$$

Th	H	T	O
3	8	2	6
		2	4
x			
1	5	3	0
7	6	5	2
9	1	8	2
			4
+			

## Progression in Calculations

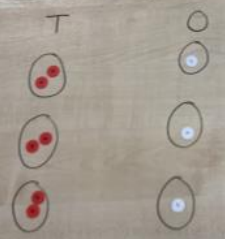
# Division


Key Language – share, group, divide, divided by, half.

Skill	Year	 <p style="text-align: center;"><b>CONCRETE</b></p>	 <p style="text-align: center;"><b>PICTORIAL</b></p>	 <p style="text-align: center;"><b>ABSTRACT</b></p>
Solve one-step problems with division (sharing)	<b>1/2</b>			<p style="text-align: center;">There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?</p> <p style="text-align: center; font-size: 2em;"><math>20 \div 5 = 4</math></p>
Solve one-step problems with division (grouping)	<b>1/2</b>			<p style="text-align: center;">There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?</p> <p style="text-align: center; font-size: 2em;"><math>20 \div 5 = 4</math></p>

Divide 2-digits by 1-digit (no exchange)

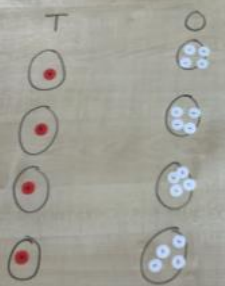
3

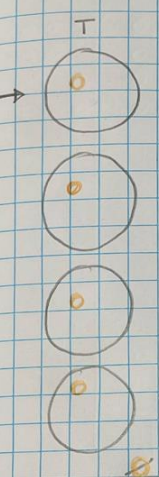
Real Story	Maths Story
<p>T</p> 	$63 \div 3 = 21$ $\begin{array}{r} 21 \\ 3 \overline{)63} \end{array}$

Real Story	Maths Story
<p>T</p> 	<p>O</p> $63 \div 3 = 21$ $\begin{array}{r} 21 \\ 3 \overline{)63} \end{array}$

Divide 2-digits by 1-digit (with exchange)

3

Real Story	Maths Story
<p>T</p> 	$56 \div 4 = 14$ $\begin{array}{r} 14 \\ 4 \overline{)56} \end{array}$

Real Story	Maths Story
<p>T</p> 	<p>O</p> $56 \div 4 = 14$ $\begin{array}{r} 14 \\ 4 \overline{)56} \end{array}$

Divide 2-digits by 1-digit (with remainders)

3/4

Real Story	Maths Story
	$74 \div 3 = 24 \text{ r } 2$ $\begin{array}{r} 24 \text{ r } 2 \\ 3 \overline{) 74} \end{array}$

Real Story	Maths Story
	$74 \div 3 = 24 \text{ r } 2$ $\begin{array}{r} 24 \text{ r } 2 \\ 3 \overline{) 74} \end{array}$

Divide 3-digits by 1-digit (with exchange)

4

Real Story	Maths Story
	$524 \div 3 = 174 \text{ r } 2$ $\begin{array}{r} 174 \text{ r } 2 \\ 3 \overline{) 524} \end{array}$

Real Story	Maths Story
	$524 \div 3 = 174 \text{ r } 2$ $\begin{array}{r} 174 \text{ r } 2 \\ 3 \overline{) 524} \end{array}$

Divide 4-digits by 1-digit

5

Real Story

Th	H	T	O
●	●	●●●	●●
●	●	●●●	●●
●	●	●●●	●●

Maths Story

$$3524 \div 3 = 1174 \text{ r } 2$$

$$\begin{array}{r} 1174 \text{ r } 2 \\ 3 \overline{) 3524} \end{array}$$

Real Story

Th	H	T	O
●	●	●●●	●●
●	●	●●●	●●
●	●	●●●	●●

Maths Story

$$3524 \div 3 = 1174 \text{ r } 2$$

$$\begin{array}{r} 1174 \text{ r } 2 \\ 3 \overline{) 3524} \end{array}$$

Divide multi-digits (short division)

5/6

Real Story

Maths Story

$$2746 \div 6 = 457 \text{ r } 4$$

$$\begin{array}{r} 0457 \text{ r } 4 \\ 6 \overline{) 2746} \end{array}$$


---

Real Story

Maths Story

$$235.45 \div 5 = 47.09$$

$$\begin{array}{r} 047.09 \\ 5 \overline{) 235.45} \end{array}$$

Divide multi-digits  
(long division)

6



Real Story	Maths Story
	$2746 \div 16 = 171 \text{ r } 10$
$16 \times 1$	$171 \text{ r } 10$
$32 \times 2$	$16 \overline{) 2746}$
$48 \times 3$	$1600 - 100$
$64 \times 4$	$\times 146$
$80 \times 5$	$640 - 40$
$96 \times 6$	$806$
$112 \times 7$	$320 - 20$
$128 \times 8$	$186$
$144 \times 9$	$160 - 10$
$160 \times 10$	$26$
$320 \times 20$	$16 - 1$
$640 \times 40$	$10$
$1600 \times 100$	