Lutton St Nicholas Primary Academy

Calculation Policy

Maths Mastery

At the depth of the mastery approach to the teaching of mathematics is the belief that **all children have the potential to succeed.** They should have access to the same curriculum content and, rather than being extended with new learning, they should **deepen their conceptual understanding by tackling challenging and varied problems.** Similarly, with calculation strategies, children must not simply rote learn procedures but demonstrate their understanding through the use of concrete materials and pictorial representations. This policy outlines the different calculation strategies that should be taught and used in EYFS through to Year 6 in line with the requirements of the 2014 Primary National Curriculum.

> The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof.
>
> 2014 Maths Programme of Study

Mathematical Language

The 2014 Primary National Curriculum is explicit in articulating the importance of children using the correct mathematical language as part of their learning (reasoning. Indeed, in certain year groups, the non-statutory guidance highlights the requirements for children to extend their language around certain concepts. It is therefore essential that teaching the strategies outlined in this policy is accompanied by the use of appropriate and precise mathematical vocabulary. New vocabulary should be introduced in a suitable context (for example, with relevant real objects, apparatus, pictures or diagrams) and explained carefully. High expectations of the mathematical language used are essential, with teachers only accepting what is correct. The agreed list of terminology is above each mathematical operation in this policy.

How to use the policy

This policy is a guide for all teaching staff. It is purposefully set out as a progression of mathematical skills and not into year group phases to encourage a flexible approach to teaching and learning. It is expected that teachers will use their professional judgement as to when consolidation of existing skills is required or if to move onto the next concept. However, the focus always **must remain on breadth and depth rather than accelerating through concepts.** Children should not be extended with new learning before they are ready, they should deepen their conceptual understanding by tackling challenging and varied problems.

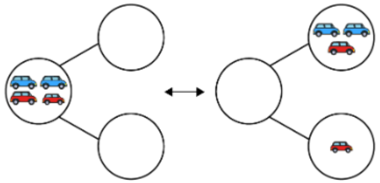
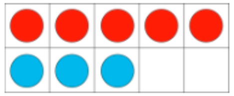
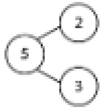
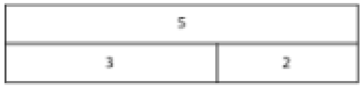
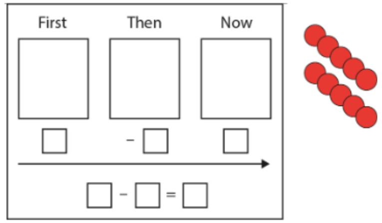
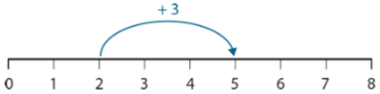
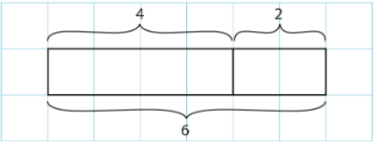
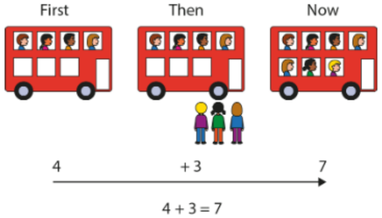
For each of the four rules of number, different strategies are laid out, together with examples of what concrete materials can be used and how, along with suggested pictorial representations. The main concrete materials to be used within all year groups are Dienes/Base 10, Place Value counters and Cuisenaire rods. The principle of the concrete-pictorial-abstract (CPA) approach (make it, draw, write it) is for children to have a true understanding by mastering all these three phrases within each mathematical concept.

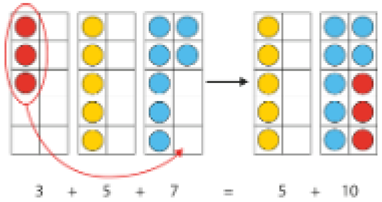
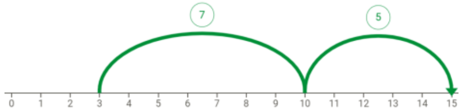
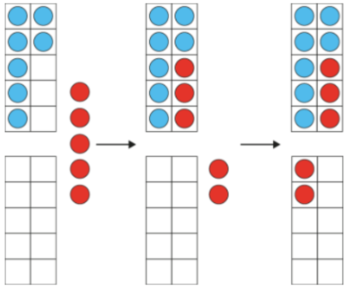
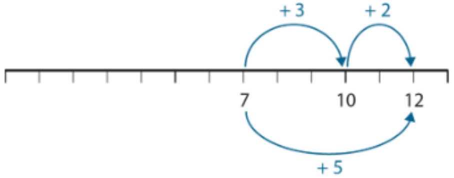
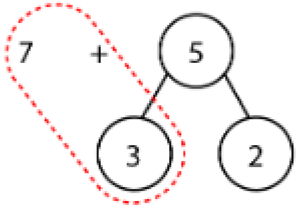
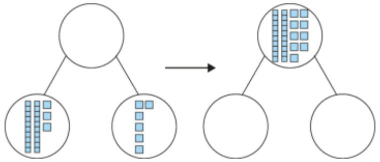
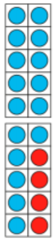
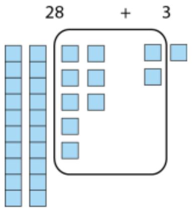
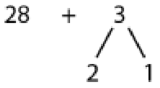
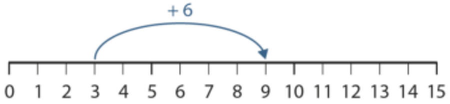
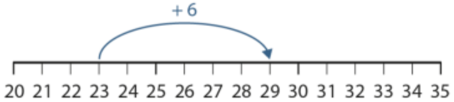
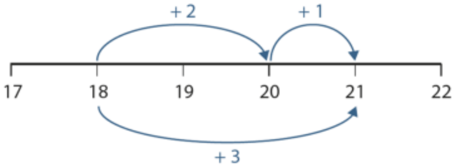
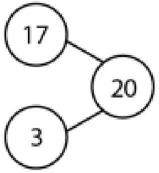
Calculation Policy: Addition Guidance

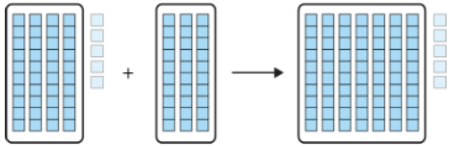
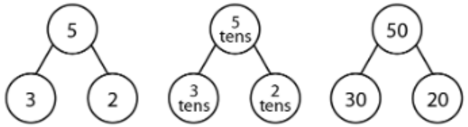
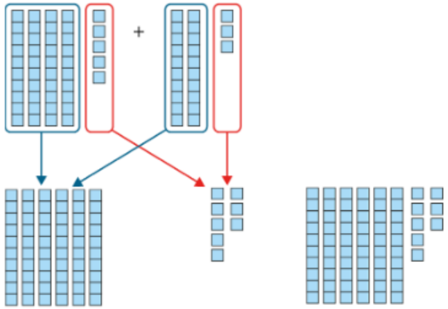
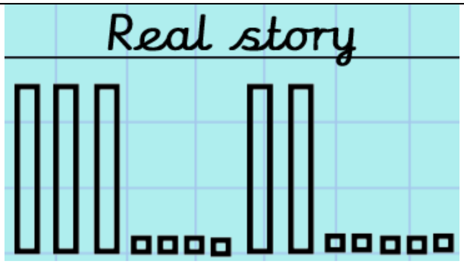
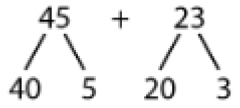
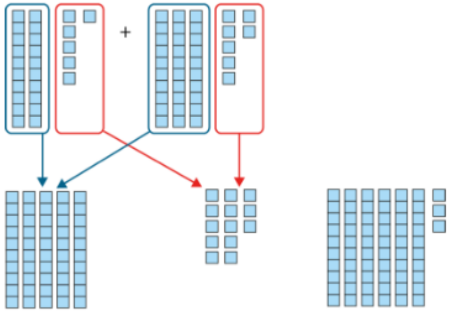
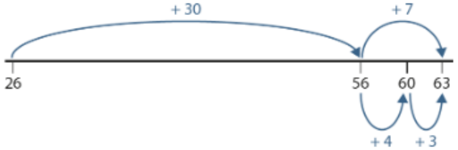
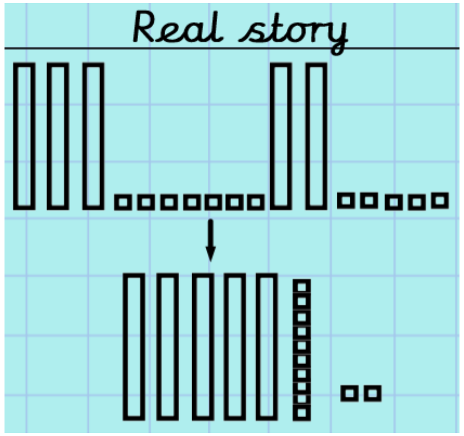
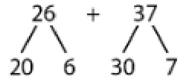
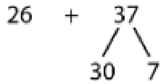
	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Combining two parts to make a whole: part whole model Start with the bigger number and count on Regrouping to make 5 using the five frame	Combining two parts to make a whole: part whole model Start with the larger number and count on Regrouping to make 10 using the ten frame	Adding 3 single digit numbers Use of Base 10 to combine two numbers	Column method – regrouping Using Place value counters (up to 3 digits)	Column method – regrouping (up to 4 digits)	Column method – regrouping Place value with decimals	Column method with regrouping Abstract methods

Calculation policy - Addition
Key Language: sum, total, parts and wholes, plus, add, total, altogether, score, more, is equal to, is the same as, exchange, inverse

Addition

Stem sentences	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
__ is the whole, __ is a part, __ is a part. __ = __ plus __ and __ plus __ = __ There are __ in total. **Year R/1**	  3 + 4 = 7 7 = 3 + 4 4 + 3 = 7 7 = 4 + 3  5 + 3 = 8 8 = 5 + 3 3 + 5 = 8 8 = 3 + 5	 3 + 2 = 5 2 + 3 = 5 5 = 3 + 2 5 = 2 + 3	 2 + 3 = 5 3 + 2 = 5 5 = 2 + 3 5 = 3 + 2 Bar model 
First… Then… Now… e.g. **First** there were 4 children on the bus, **then** 3 children got on. **Now** there are 7 children on the bus. **Year R/1**	Role play getting ‘on the bus’ or use a toy bus. 	 4 + 3 = 7  2 + 3 = 5	 

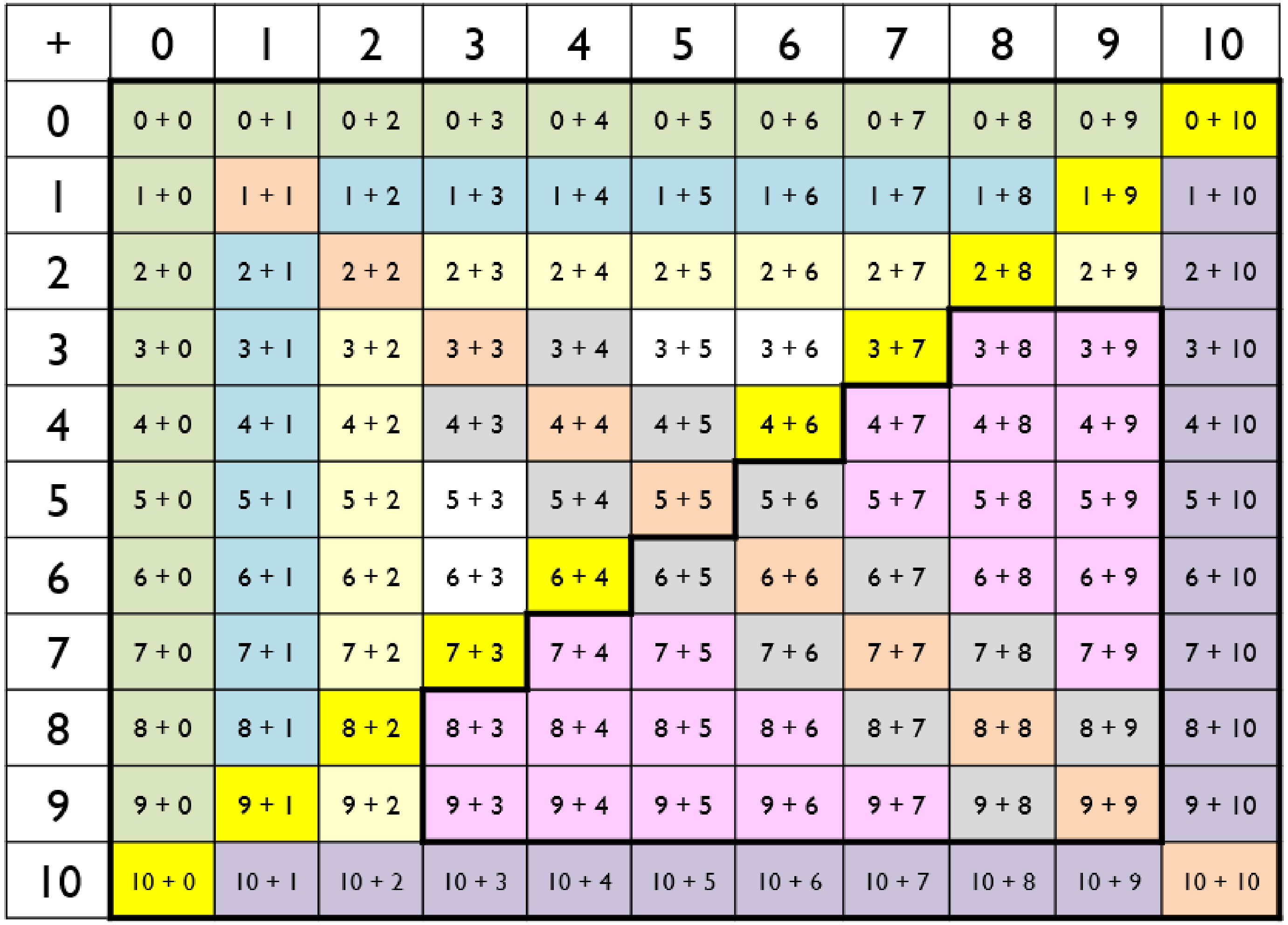
			4 + 2 = 6
We can look for pairs of addends which sum to 10. __ plus __ is equal to 10, then 10 plus __ is equal to __. **Year 2**			3 + 5 + 7 = 3 + 7 + 5 = 10 + 5 = 15
First I partition the __: __ plus __ is equal to __. Then __ plus __ is equal to ten … and ten plus __ is equal to __. **Year 2**	 7 + 5 = 7 + 3 = 10 10 + 2 = 12	 7 + 5 = 7 + 3 = 10 10 + 2 = 12	 7 + 3 = 10 10 + 2 = 12
I know that __ plus __ is equal to __. (single-digit fact) So __ plus __ is equal to __. (related two-digit plus single digit fact) I know that __ plus __ is equal to ten so __ plus __ is equal to __. **Year 2**	 3 + 6 = 9 23 + 6 = 29  16 + 4 = 20  	  3 + 6 = 9  23 + 6 = 29	 17 + 3 = 20

I know that __ plus __ is equal to __. So __ tens plus __ tens is equal to __ tens. __ tens and __ ones, plus __ tens is equal to __ tens and __ ones. **Year 2**	 40 + 30 = 70 so 45 + 30 = 75	 45 + 30 = 75	 2 + 3 = 5 2 tens + 3 tens = 5 tens 20 + 30 = 50
First I partition the __ into __ and __, and the __ into __ and __. __ plus __ is equal to __... (addition of the tens) __ plus __ is equal to __... (addition of the ones) and __ plus __ is equal to __. (addition of the tens and ones) So __ plus __ is equal to __. (summary of the overall calculation) **Year 2**	 45 + 23 = 60 + 8 = 68	 34 + 25 =	 40 + 20 = 60 5 + 3 = 8 60 + 8 = 68
First I partition the __ into __ and __, and the __ into __ and __. __ plus __ is equal to __... (addition of the tens) __ plus __ is equal to __... (addition of the ones) and __ plus __ is equal to __. (addition of the tens and ones) So __ plus __ is equal to __. (summary of the overall calculation) **Year 2**	 26 + 37 = 50 + 13 = 63	 26 + 30 = 56 56 + 7 = 63  37 + 25 = 62	 or  20 + 30 = 50 6 + 7 = 13 50 + 13 = 63 26 + 30 = 56 56 + 7 = 63

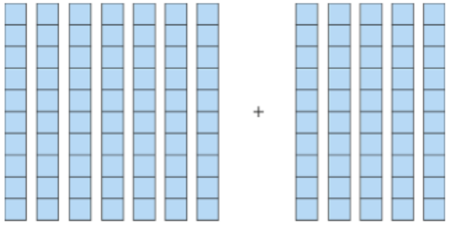
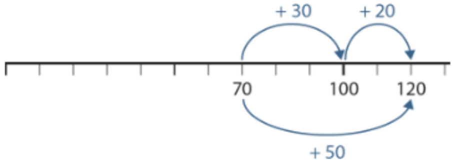
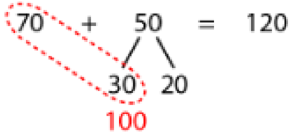
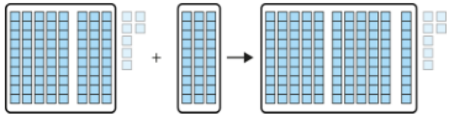
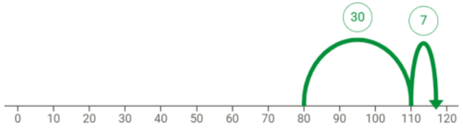
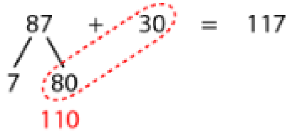
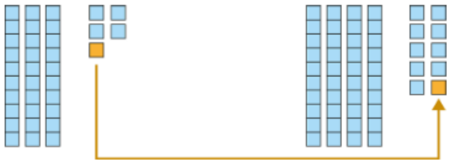
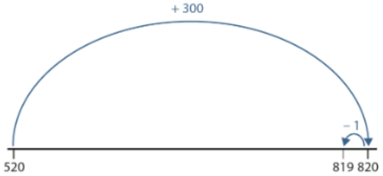
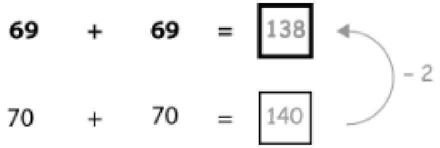
Addition Facts

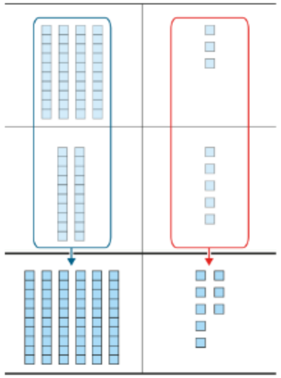
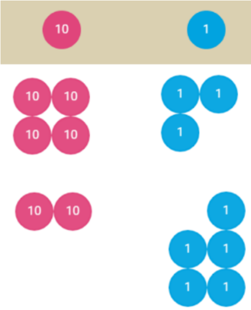
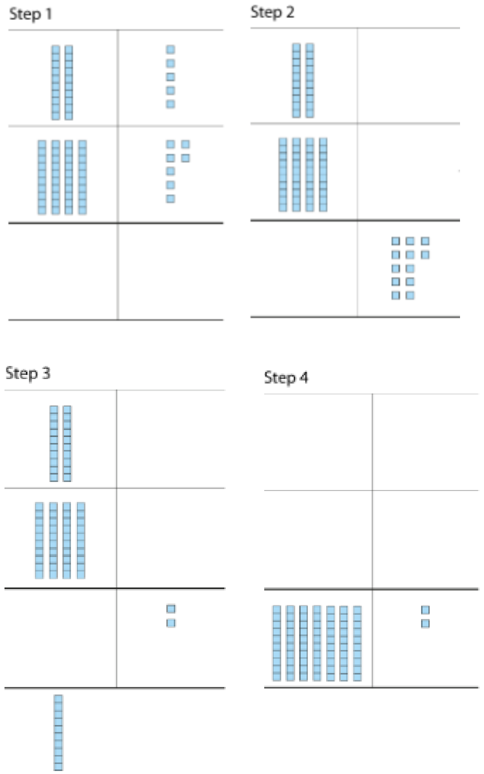
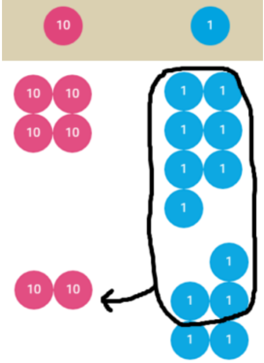
- Adding 1
- Bonds to 10
- Adding 10
- Bridging/compensating
- Adding 2
- Adding 0
- Doubles
- Near doubles

Y1 facts
Y2 facts



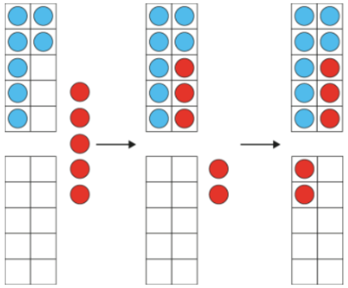
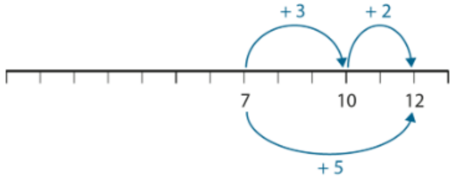
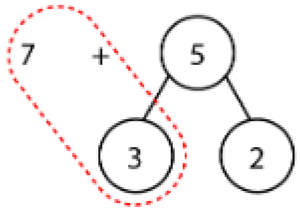
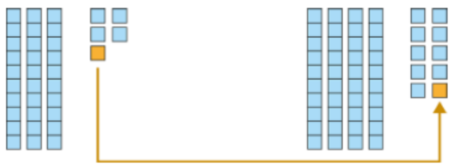
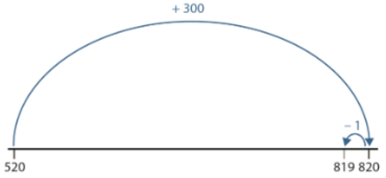
+	0	1	2	3	4	5	6	7	8	9	10
0	0 + 0	0 + 1	0 + 2	0 + 3	0 + 4	0 + 5	0 + 6	0 + 7	0 + 8	0 + 9	0 + 10
1	1 + 0	1 + 1	1 + 2	1 + 3	1 + 4	1 + 5	1 + 6	1 + 7	1 + 8	1 + 9	1 + 10
2	2 + 0	2 + 1	2 + 2	2 + 3	2 + 4	2 + 5	2 + 6	2 + 7	2 + 8	2 + 9	2 + 10
3	3 + 0	3 + 1	3 + 2	3 + 3	3 + 4	3 + 5	3 + 6	3 + 7	3 + 8	3 + 9	3 + 10
4	4 + 0	4 + 1	4 + 2	4 + 3	4 + 4	4 + 5	4 + 6	4 + 7	4 + 8	4 + 9	4 + 10
5	5 + 0	5 + 1	5 + 2	5 + 3	5 + 4	5 + 5	5 + 6	5 + 7	5 + 8	5 + 9	5 + 10
6	6 + 0	6 + 1	6 + 2	6 + 3	6 + 4	6 + 5	6 + 6	6 + 7	6 + 8	6 + 9	6 + 10
7	7 + 0	7 + 1	7 + 2	7 + 3	7 + 4	7 + 5	7 + 6	7 + 7	7 + 8	7 + 9	7 + 10
8	8 + 0	8 + 1	8 + 2	8 + 3	8 + 4	8 + 5	8 + 6	8 + 7	8 + 8	8 + 9	8 + 10
9	9 + 0	9 + 1	9 + 2	9 + 3	9 + 4	9 + 5	9 + 6	9 + 7	9 + 8	9 + 9	9 + 10
10	10 + 0	10 + 1	10 + 2	10 + 3	10 + 4	10 + 5	10 + 6	10 + 7	10 + 8	10 + 9	10 + 10

Stem sentences	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
I know that __ plus __ is equal to __. (single-digit addends) So __ tens plus __ tens is equal to __ tens. (multiple-of-ten addends) __ plus __ is equal to one hundred and __. **Year 3**	 7 + 5 = 12 7 tens + 5 tens = 12 tens 70 + 50 = 120	 70 + 50 = 70 + 30 = 100 100 + 20 = 120	 70 + 50 = 70 + 30 + 20 = 100 + 20 = 120
I know that __ plus __ is equal to __. (single-digit addends) So __ tens plus __ tens is equal to __ tens. (multiple-of-ten addends) __ plus __ is equal to one hundred and __. **Year 3**	 87 + 30 = 110 + 7 = 117	 87 + 30 = 80 + 30 + 7 = 110 + 7 = 117	 87 + 30 = 80 + 7 + 30 = 110 + 7 = 117
First we add: __ plus __ is equal to __ … … then we adjust: __ minus __ is equal to __. **Year 3**	 35 + 49 = 34 + 50 = 84	 520 + 299 = 520 + 300 = 820 820 – 1 = 819	

We line up the ones; __ ones plus __ ones. We line up the tens: __ tens plus __ tens. The __ is in the ones column – it represents __ ones. The __ is in the ones column – it represents __ ones. __ ones plus __ ones is equal to __ ones. The __ is in the tens column – it represents __ tens. The __ is in the tens column – it represents __ tens. __ tens plus __ tens is equal to __ tens. In column addition we start at the right-hand side. **Year 3**	Start with two-digit numbers to exemplify lining up the columns. 	Children could draw place value counters. 	Start with two-digit numbers to exemplify lining up the columns. 4 3 + 2 5 462 + 205
If the column sum is equal to ten or more, we must regroup. **Year 3**	Start with two-digit numbers to exemplify the regrouping. 	Children could draw place value counters. 	Start with two-digit numbers to exemplify the regrouping. 2 5 + 4 7 2 1 2 5 + 4 7 7 2 1 567 +233 800 1 1

If the column sum is equal to ten or more, we must regroup. **Year 4**	See Year 3 examples	See Year 3 examples	6, 5 8 4 + 2, 7 3 9 9, 3 2 3 1 1 1 £ 2 4 . 5 5 + £ 1 7 . 8 2 £ 4 2 . 3 7 1 1
If the column sum is equal to ten or more, we must regroup. **Years 5 and 6**	See Year 3 examples	See Year 3 examples	As in Year 4 but using numbers with more than 4 digits

Addition – Key mental strategies for Key Stage 2

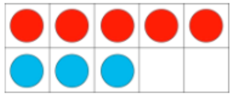
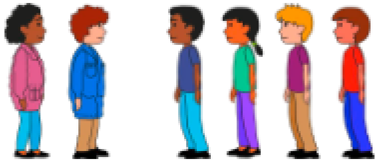
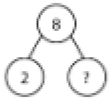
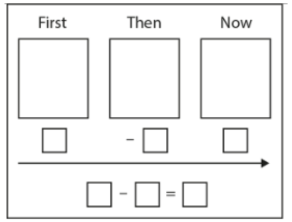
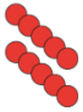
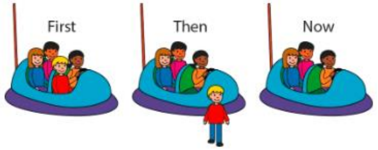
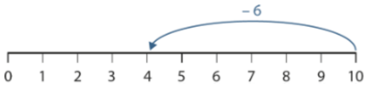
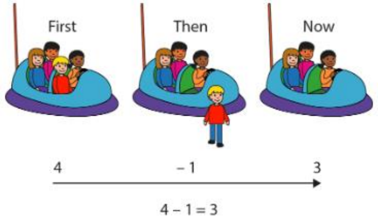
Strategy	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
Bridging through a multiple of 10, 100, etc **Years 3, 4, 5 and 6**	 7 + 5 = 7 + 3 = 10 10 + 2 = 12	 7 + 5 = 7 + 3 = 10 10 + 2 = 12	 7 + 3 = 10 10 + 2 = 12
Compensating – rounding to the nearest multiple 10, 100, etc and adjusting **Years 3, 4, 5 and 6**	 35 + 49 = 34 + 50 = 84	 520 + 299 = 520 + 300 = 820 820 – 1 = 819	$69 + 69 = \boxed{138}$ $70 + 70 = \boxed{140}$ - 2

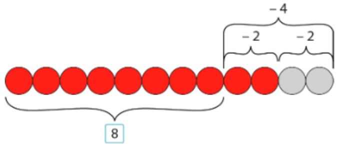
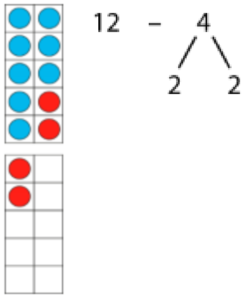
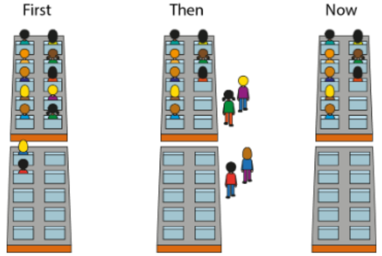
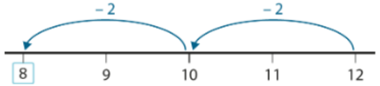
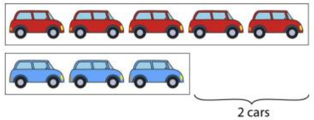
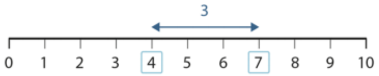
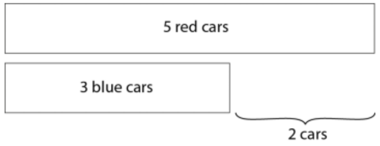
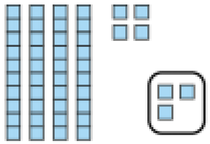
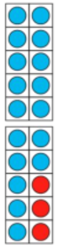
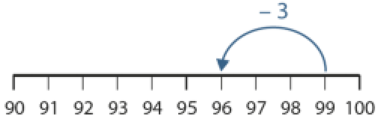
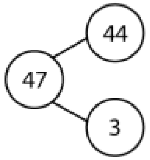
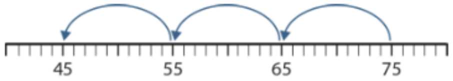
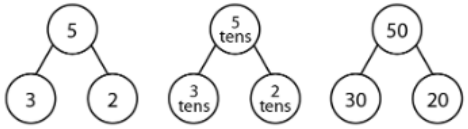
Calculation Policy: Subtraction Guidance

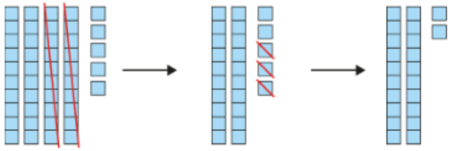
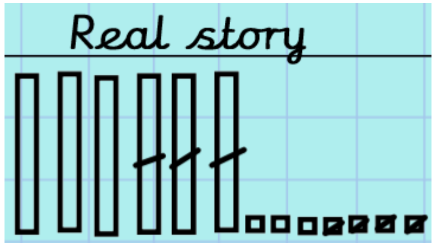
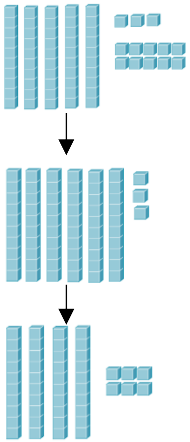
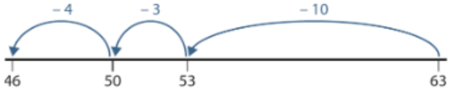
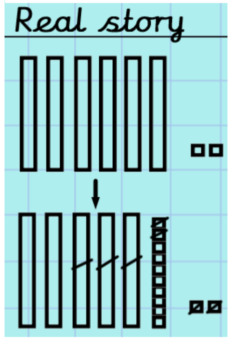
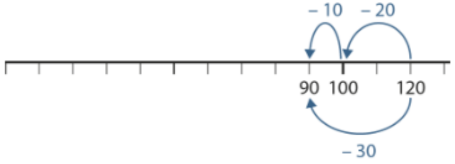
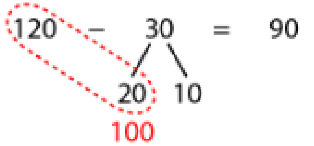
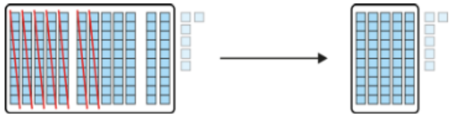
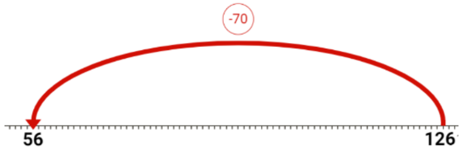
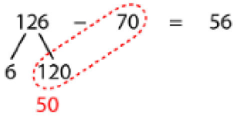
Subtraction	Counting back Taking away ones Part whole model Making 5 using the five frame	Counting back Taking away ones Find the difference Part whole model Make 10 using the 10 frame	Counting back Find the difference Part whole model Make 10 Use of Base 10	Column method with regrouping (up to 3 digits using Place value counters	Column method with regrouping	Column method with regrouping Abstract for whole numbers Place value with decimals	Column method with regrouping Abstract methods

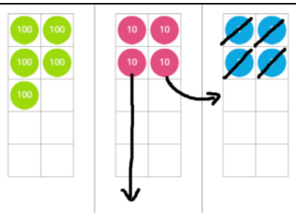
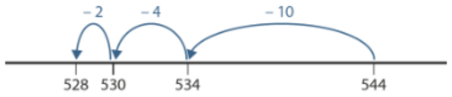
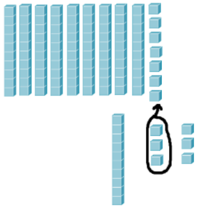
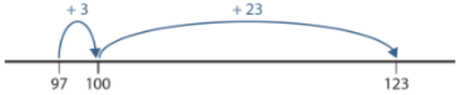
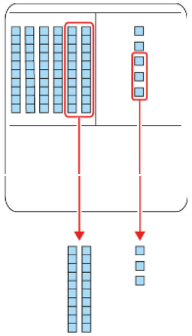
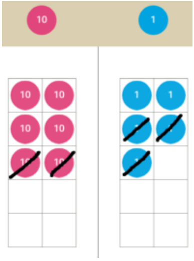
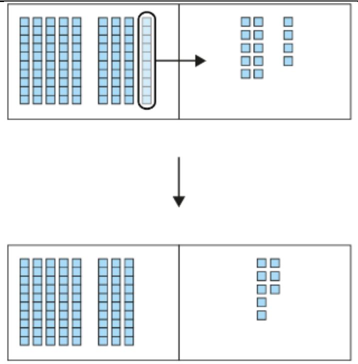
Calculation policy - Subtraction
Key Language: take away, less than, the difference, subtract, minus, fewer, decrease, exchange, answer, inverse

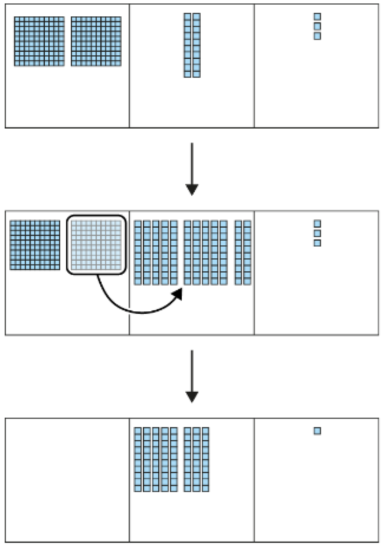
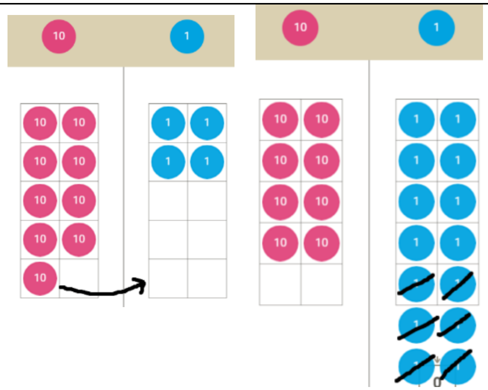
Subtraction

Stem sentences	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
__ is the whole, __ is a part, __ is a part. __ = __ minus __ and __ minus __ = __ **Year R/1**	I have 8 counters. 5 counters are red. How many are blue? 	There are 6 children. 2 have their coat on. How many do not have their coat on? 	There are 8 flowers. 2 are red and the rest are yellow. How many are yellow?   8 – 2 = 6
First… Then… Now… e.g. **First** there were 4 children in the car, **then** 1 child got out. **Now** there are 3 children in the car. **Year R/1**	Role play 'getting out of a car'.  	 4 - 1 = 3 3 = 4 – 1  10 – 6 = 4	

We partition the __ into __ and __. First we subtract the __ from __ to get to 10. Then we subtract the remaining __ from 10. We know 10 minus __ is equal to __. **Year 2**	 12 – 4 = 12 – 2 = 10 10 – 2 = 8 	First there were 12 children on the ride. Then 4 got off. Now there are 8 children on the ride. 	 12 – 4 = 12 – 2 = 10 10 – 2 = 4
There are more __ than __. There are fewer __ than __. The difference between __ and __ is __. **Year 2**	 The difference between 2 and 5 is 3. The difference between 5 and 2 is 3.	 The difference between 4 and 7 is 3. The difference between 7 and 4 is 3.	 5 – 3 = 2
I know that __ minus __ is equal to __. (single-digit fact) So __ minus __ is equal to __. (related two-digit minus single digit fact) I know that ten minus __ is equal to __ so __ minus __ is equal to __. **Year 2**	 7 – 3 = 4 47 – 3 = 44  **20 – 3 =17**	 9 – 3 = 6 99 – 3 = 96	 47 – 3 = 44
I know that __ minus __ is equal to __. So __ tens minus __ tens is equal to __ tens. **Year 2**	 70 – 30 = 40 so 75 – 30 = 45	 75 – 30 = 45	 5 – 3 = 2 5 tens – 3 tens = 2 tens 50 – 30 = 20

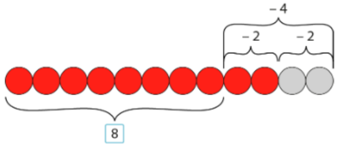
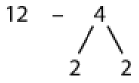
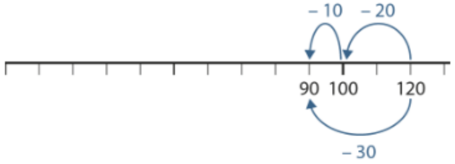
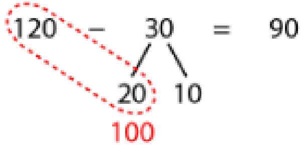
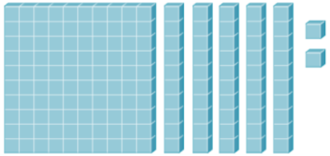
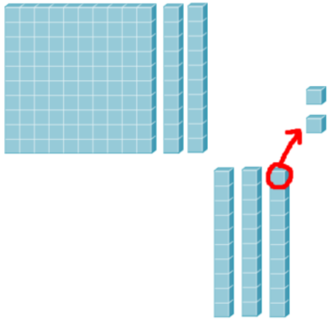
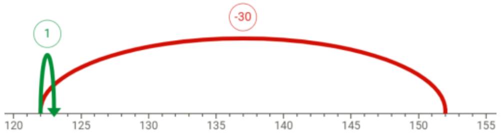
First I subtract the tens, then I subtract the ones. **Year 2**	 45 – 23 = 45 – 20 = 25 25 – 3 = 22	67 – 34 = 33  	45 – 23 = 22
First I subtract the tens, then I subtract the ones. **Year 2**		  62 – 34 = 28	63 – 17 = 46
I know that __ minus __ is equal to __. (bridging ten) So __ tens minus __ tens is equal to __ tens. (bridging ten tens) One hundred and __ minus __ is equal to __. **Year 3**	See Year 2 (bridging)	 120 – 30 = 120 – 20 = 100 100 – 10 = 90	 120 – 30 = 120 – 20 = 100 100 – 10 = 90
I know that __ minus __ is equal to __. (bridging ten) So __ tens minus __ tens is equal to __ tens. (bridging ten tens) One hundred and __ minus __ is equal to __. **Year 3**	 126 – 70 = 56	 	 126 – 70 = 120 – 70 + 6 = 50 + 6 = 56

We partition the __ into __ and __. First we subtract the __ from __ to get to a multiple of 10. Then we subtract the remaining __ from the multiple of 10. We know 10 minus __ is equal to __ so __ minus __ is equal to __. **Year 3**		544 – 16 	Count back to multiples of 10/100
We partition the __ into __ and __. First we add the __ to __ to get to 100. Then we add the remaining __ to 100. We know 100 plus __ is equal to __. **Year 3**		 123 – 97 = 26	Count on to multiples of 10/100
We line up the ones; __ ones plus __ ones. We line up the tens: __ tens plus __ tens. The __ is in the ones column – it represents __ ones. __ ones minus __ ones is equal to __ ones. The __ is in the tens column – it represents __ tens. __ tens minus __ tens is equal to __ tens. In column subtraction we start at the right-hand side. **Year 3**		Children could draw place value counters. 	$\begin{array}{r} 6\;\;5 \\ -\;2\;\;3 \\ \hline 4\;\;2 \\ \hline \end{array}$ $\begin{array}{r} 4\;\;6\;\;2 \\ -\;2\;\;5\;\;1 \\ \hline \\ \hline \end{array}$
If there is an insufficient number to subtract from in a given column, we must exchange from the column to the left. **Year 3**		Children could draw place value counters.	$\begin{array}{rc\|c} & 10s & 1s \\ \hline & \cancel{9}^{8} & {}^{1}4 \\ - & & 6 \\ \hline & & \\ \hline \end{array}$ $\begin{array}{rc\|c} & 10s & 1s \\ \hline & \cancel{9}^{8} & {}^{1}4 \\ - & & 6 \\ \hline & 8 & 8 \\ \hline \end{array}$

			$\begin{array}{rccc} & 100s & 10s & 1s \\ & 2 & 2 & 3 \\ - & 1 & 4 & 2 \\ \hline & & & \\ \hline \end{array}$ $\begin{array}{rccc} & 100s & 10s & 1s \\ & \cancel{2}^{1} & {}^{1}2 & 3 \\ - & 1 & 4 & 2 \\ \hline & & & \\ \hline \end{array}$ $\begin{array}{rccc} & 100s & 10s & 1s \\ & \cancel{2}^{1} & {}^{1}2 & 3 \\ - & 1 & 4 & 2 \\ \hline & 0 & 8 & 1 \end{array}$
If there is an insufficient number to subtract from in a given column, we must exchange from the column to the left. **Year 4**	See Year 3 examples	See Year 3 examples	$\begin{array}{rcccc} & {}^{5}\cancel{6}, & {}^{14}\cancel{5} & {}^{12}\cancel{3} & {}^{1}8 \\ - & 2, & 7 & 8 & 9 \\ \hline & 3, & 7 & 4 & 9 \\ \hline \end{array}$ $\begin{array}{rcccccc} & £ & 2 & {}^{8}\cancel{9} & . & {}^{14}\cancel{5} & {}^{1}0 \\ - & £ & 1 & 8 & . & 9 & 4 \\ \hline & £ & 1 & 0 & . & 5 & 6 \\ \hline \end{array}$

If there is an insufficient number to subtract from in a given column, we must exchange from the column to the left. **Years 5 and 6**	See Year 3 examples	See Year 3 examples	As in Year 4 but using numbers with more than 4 digits

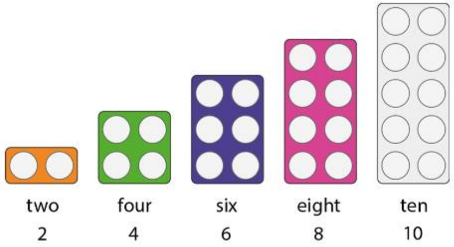
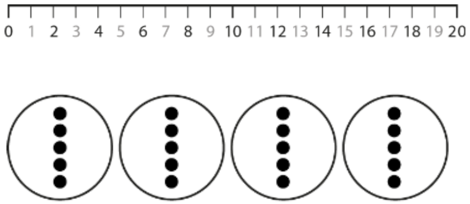
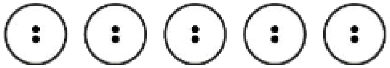
Subtraction – Key mental strategies for Key Stage 2

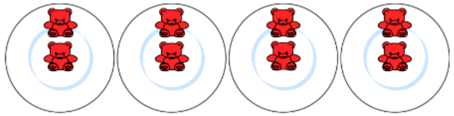
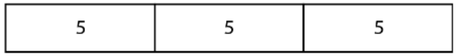
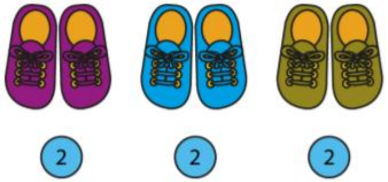
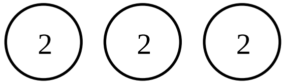
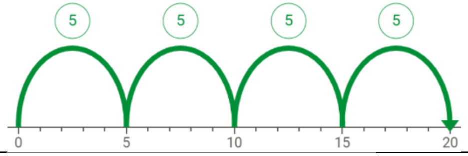
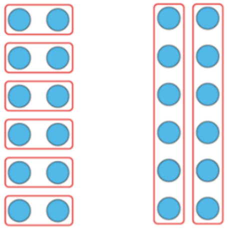
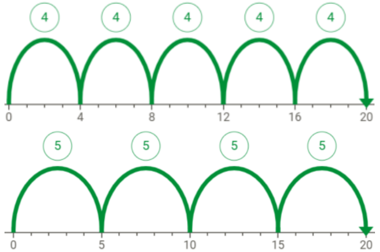
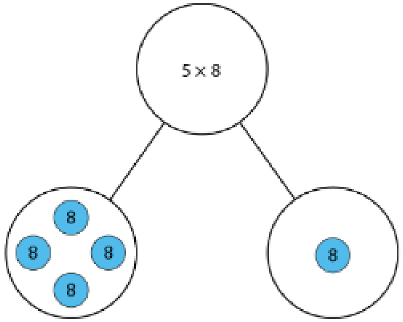
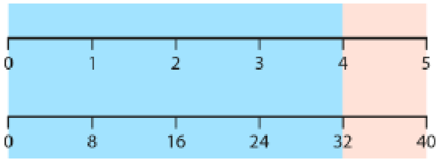
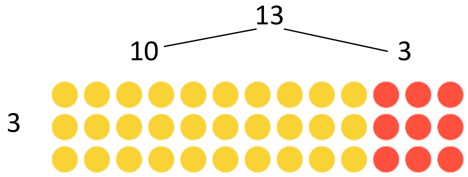
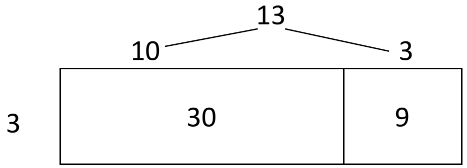
Strategy	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
Bridging through a multiple of 10, 100, etc **Years 3, 4, 5 and 6**	 12 – 4 = 12 – 2 = 10 10 – 2 = 8 	 120 – 30 = 120 – 20 = 100 100 – 10 = 90	 120 – 30 = 120 – 20 = 100 100 – 10 = 90
Compensating – rounding to the nearest multiple 10, 100, etc and adjusting **Years 3, 4, 5 and 6**	 152 – 29 		152 – 30 = 122 122 + 1 = 123

Calculation Policy: Multiplication Guidance

	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Multiplication	ELG: solve problems, including doubling	Doubling	Arrays – showing commutative multiplication	Arrays 2d x 1d	Column multiplication – introduced with place value counters (2 and 3 digit multiplied by 1 digit)	Column multiplication Abstract only but might need a repeat of year 4 first (up to 4 digit numbers multiplied by 1 or 2 digits)	Column multiplication Abstract methods

Multiplication

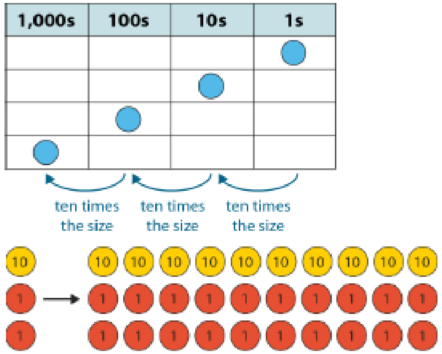
Stem sentences	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
One group of two, two groups of two, three groups of 2, … Ten, twenty, thirty, … One five, two fives, three fives, … **Year R/1**			10, 20, 30, …
There are __ coins. Each coin has a value of __p. This is __p. **Year 1**	 Representing each group by one object		Five 2p coins = 10p

There are __ in each group. There are __ groups. There are __ in a group and __ groups. **Year 2**	 		2 + 2 + 2 + 2 = 8 2 x 4 = 8 5 + 5 + 5 = 15 5 x 3 = 15
Factor times factor is equal to the product. The product is equal to factor times factor. **Year 2**	 Unitising equal groups – representing each group by one object	 	2 x 3 = 6 6 = 2 x 3
__ times __ can represent __ in a group and __ groups. It can also represent __ groups of __. Multiplication is commutative. **Year 2**			2 x 5 = 5 x 2
__ is equal to __ plus __, so __ times __ is equal to __ times __ plus __ times __. __ is equal to __ minus __, so __ times __ is equal to __ times __ minus __ times __. Multiplication is distributive. (NCETM Year 4 unit 2.10) **Year 3**			5 = 4 + 1 5 x 8 = 4 x 8 + 1 x 8 = 32 + 8 = 40 4 = 5 – 1 4 x 8 = 5 x 8 – 1 x 8 = 40 – 8 = 32
__ is equal to __ plus __, so __ times __ is equal to __ times __ plus __ times __. __ is equal to __ minus __, so __ times __ is equal to __ times __ minus __ times __.			3 x 13 = 3 x 10 + 3 x 3 = 30 + 9 = 39

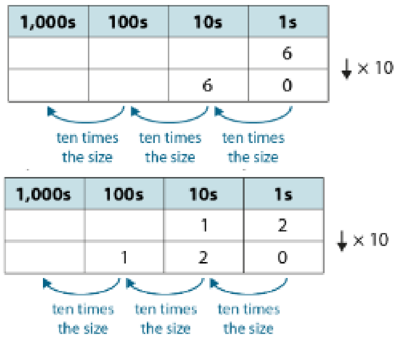
<table>
<tr><td>Multiplication is distributive.

(NCETM Year 4 unit 2.10)
Year 3</td><td></td><td></td><td></td></tr>
<tr><td>When multiplying by 10 it will make the number 10 times bigger.

Year 4</td><td>



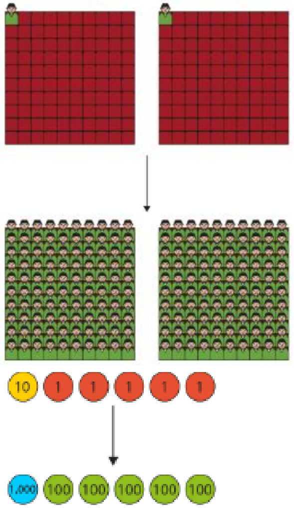
</td><td>



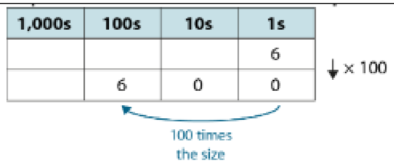
</td><td>6 x 10 = 60

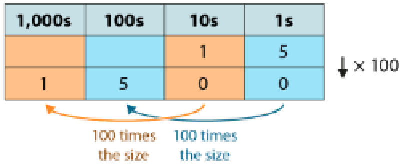
12 x 10 = 120</td></tr>
<tr><td>All multiples of 100 have both a tens and ones digit of 0.
When a number is multiplied by 100, the product is a multiple of 100.

Year 4</td><td>



</td><td>

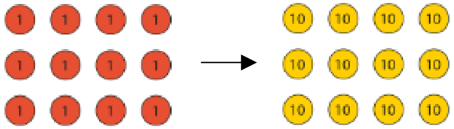




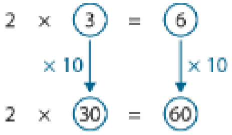
</td><td>2 x 100 = 200
There are 100 times as many people as before.

15 x 100 = 1500</td></tr>
<tr><td>If one factor is made ten times the size, the product will be ten times the size.

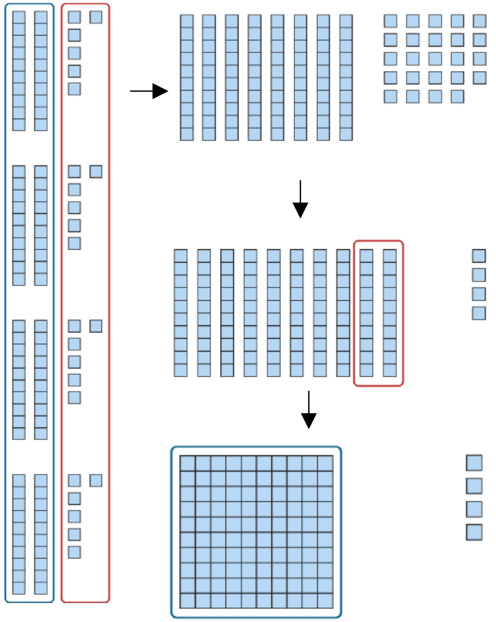
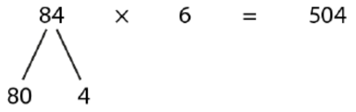
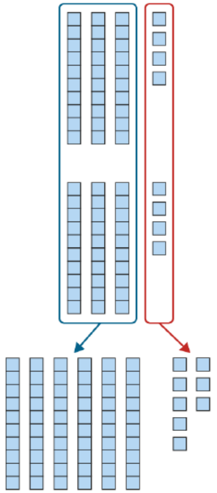
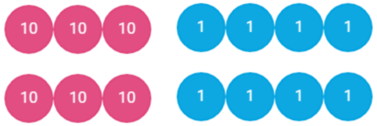
Year 4</td><td>

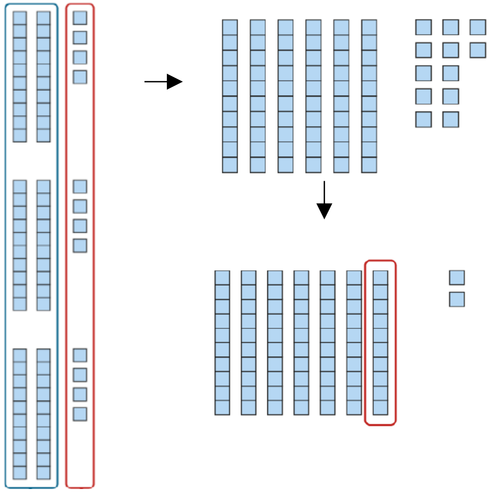
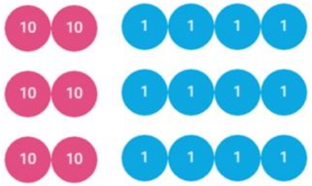
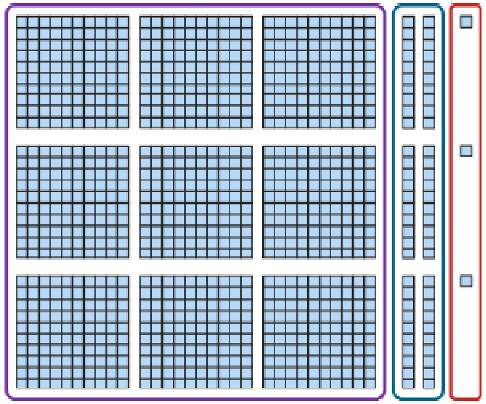
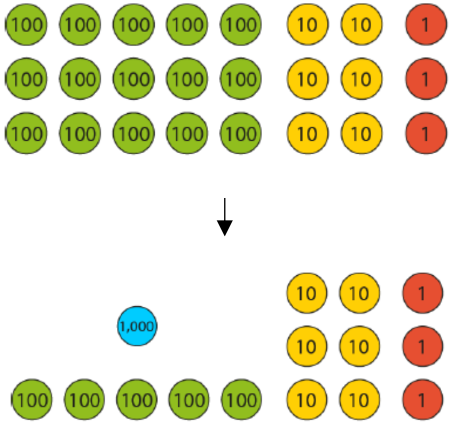


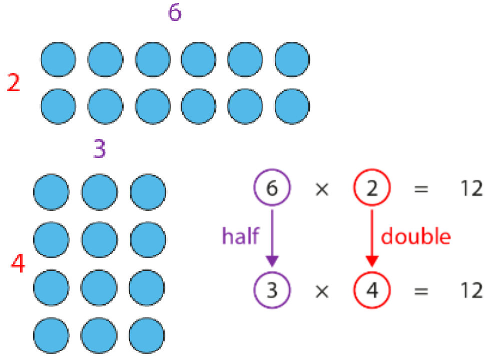
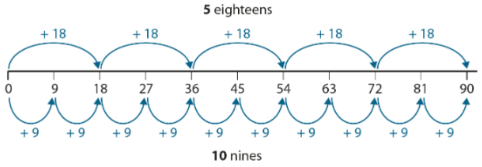
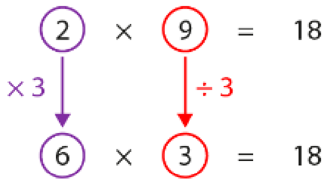
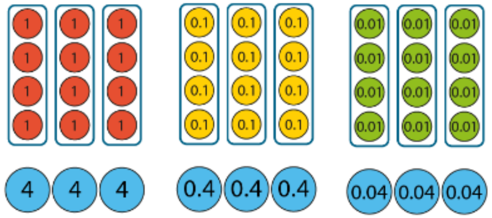
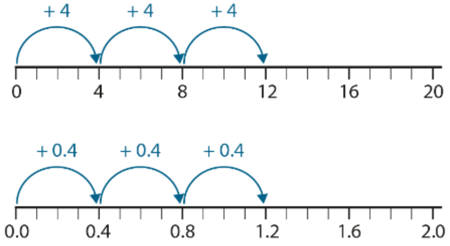
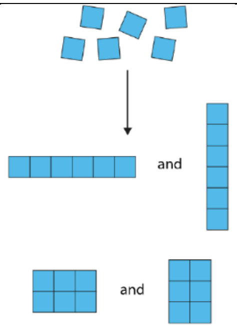
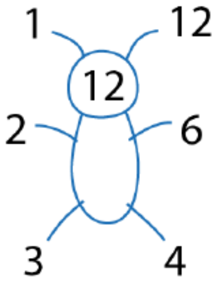
</td><td>

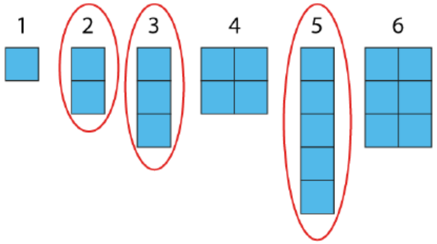
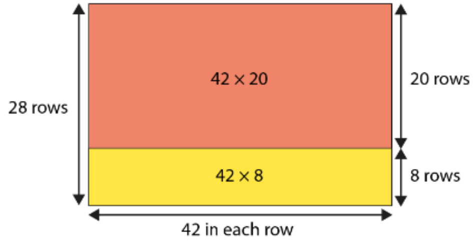
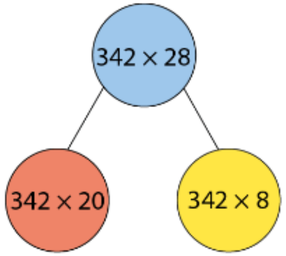
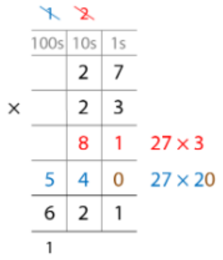
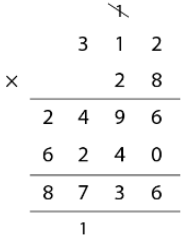


</td><td>4 x 3 = 12 so 4 x 30 = 120</td></tr>
</table>

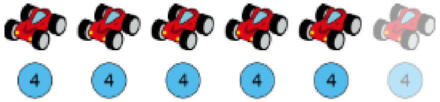
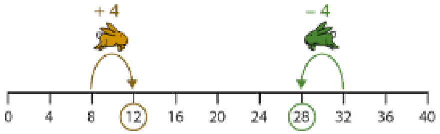
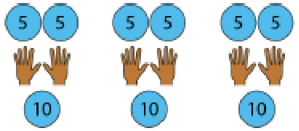
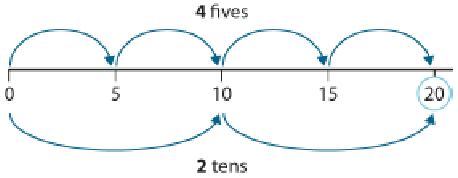
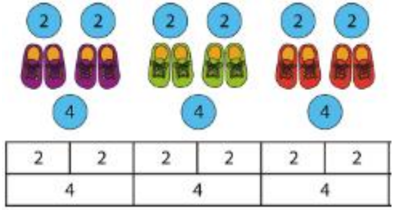
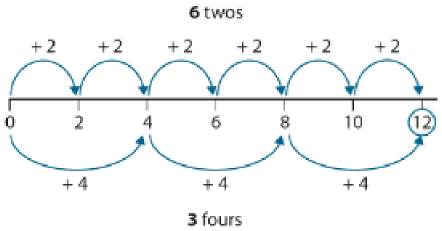
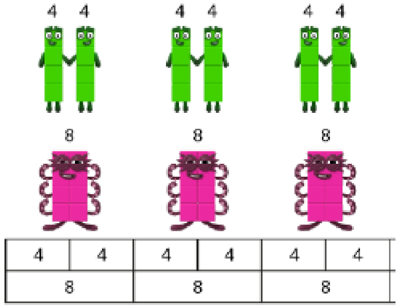
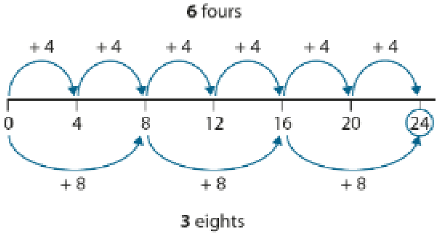
If there are ten or more ones, we must regroup the ones into tens and ones. If there are ten or more tens, we must regroup the tens into hundreds and tens. Multiplication is distributive. **Year 4**		 80 × 6 = 480 4 × 6 = 24 480 + 24 = 504	84 x 6 = 80 x 6 + 4 x 6 = 480 + 24 = 504
We work from the least significant digit, on the right, to the most significant digit, on the left. Multiplication is distributive. **Year 4**		 34 x 2 = 60 + 8 = 68	10s 1s 3 4 × 2 8 2 × 4 ones = 8 ones 6 0 2 × 3 tens = 6 tens 6 8 ↓ 2 1 × 4 8 4

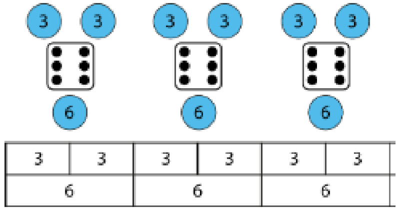
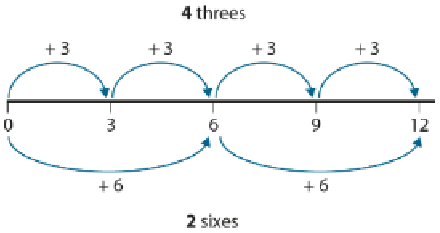
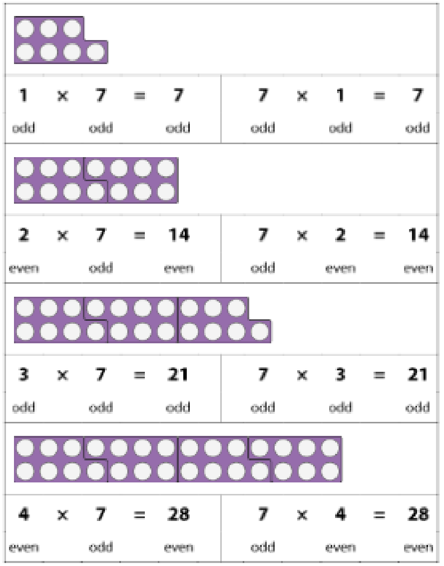
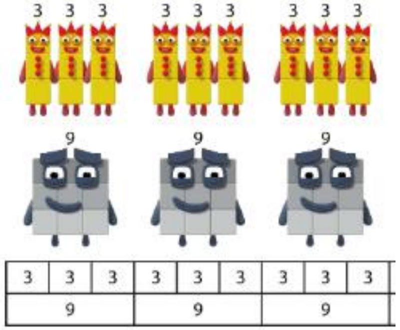
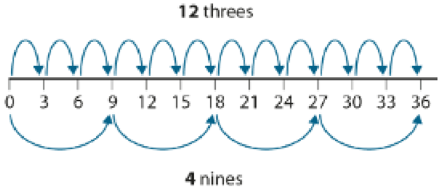
If there are ten or more ones, we must regroup the ones into tens and ones. If there are ten or more tens, we must regroup the tens into hundreds and tens. Multiplication is distributive. **Year 4**		 24 x 3 = 60 + 12 = 72 ↓	$\begin{array}{rrr} & 10s & 1s \\ & 2 & 4 \\ \times & & 3 \\ \hline & 1 & 2 \\ & 6 & 0 \\ \hline & 7 & 2 \end{array}$ 3 × 4 ones = 12 ones = 1 ten + 2 ones 3 × 2 tens = 6 tens ↓ $\begin{array}{rrr} & 1 & 8 \\ \times & & 5 \\ \hline & 9 & 0 \\ \hline & 4 & \end{array}$ $\begin{array}{rrrr} & & 3 & 8 \\ \times & & & 4 \\ \hline & 1 & 5 & 2 \\ \hline & & 3 & \end{array}$
If there are ten or more ones, we must regroup the ones into tens and ones. If there are ten or more tens, we must regroup the tens into hundreds and tens. If there are ten or more hundreds, we must regroup the hundreds into thousands and hundred. Multiplication is distributive. **Year 4**	 321 x 3 = 963	 521 x 3 = 1000 + 500 + 60 + 3 = 1563	$\begin{array}{rrrr} & 100s & 10s & 1s \\ & 3 & 2 & 1 \\ \times & & & 3 \\ \hline & & & 3 \\ & & 6 & 0 \\ & 9 & 0 & 0 \\ \hline & 9 & 6 & 3 \end{array}$ 3 × 1 ones = 3 ones 3 × 2 tens = 6 tens 3 × 3 hundreds = 9 hundreds $\begin{array}{rrrr} & 3 & 2 & 1 \\ \times & & & 3 \\ \hline & 9 & 6 & 3 \end{array}$ $\begin{array}{rrrrr} & 1{,}000s & 100s & 10s & 1s \\ & & 5 & 2 & 1 \\ \times & & & & 3 \\ \hline & & & & 3 \\ & & & 6 & 0 \\ & 1 & 5 & 0 & 0 \\ \hline & 1 & 5 & 6 & 3 \end{array}$ $\begin{array}{rrrrr} & & 3 & 6 & 7 \\ \times & & & & 4 \\ \hline & 1 & 4 & 6 & 8 \\ \hline & & 2 & 2 & \end{array}$

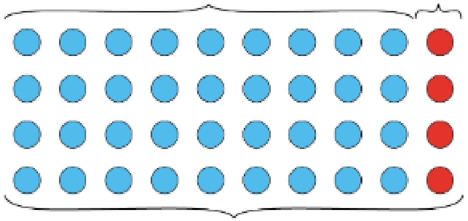
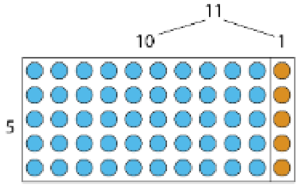
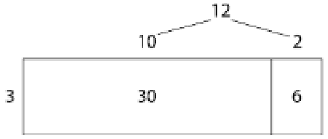
If there is a multiplicative increase in one factor and a multiplicative decrease in the other, the product remains the same. If I multiply one factor by __, I must divide the other factor by __ for the product to remain the same. **Year 5 and 6**	 	 	
If one factor is made one tenth of the size, the product will be one tenth of the size. If one factor is made one hundredth of the size, the product will be one hundredth of the size. I move the digits of the number I am multiplying __ places to the left until I get a whole number; then I multiply; then I move the digits of the product __ places to the right. **Year 5**	 4 x 3 = 12 0.4 x 3 = 1.2 0.04 x 3 = 0.12	 	4 5 6 × 4 1 8 2 4 2 2 4 . 5 6 × 4 1 8 . 2 4 2 2
Numbers that have more than two factors are composite numbers. **Year 5**	 Factors of 6 are 1, 2, 3 and 6.	 Factor bugs	Factors of 6 are 1, 2, 3 and 6.

Numbers that have only two factors are prime numbers. **Year 5**			17 is a prime number because its only factors are 1 and 17.
To multiply two two-digit numbers, first multiply by the ones, then multiply by the tens, then add them together. To multiply a three-digit number by a two-digit number, first multiply by the ones, then multiply by the tens, then add them together. **Year 6**			 

Multiplication – Key mental strategies for Key Stage 2

Strategy	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
Adjacent multiples of __ have a difference of __. **Year 3 onwards**			4 x 6 = 4 x 5 + 4 4 x 9 = 4 x 10 - 4
Products in the 10 times table are double the products in the 5 times table. Products in the 5 times table are half of the products in the 10 times table. (NCETM Year 2 unit 2.5) **Year 3 onwards**			5 x 4 = 10 x 2
Products in the 4 times table are double the products in the 2 times table. Products in the 2 times table are half of the products in the 4 times table. **Year 3 onwards**			2 x 6 = 4 x 3
Products in the 8 times table are double the products in the 4 times table. Products in the 4 times table are half of the products in the 8 times table. **Year 3 onwards**			4 x 6 = 8 x 3

Products in the 6 times table are double the products in the 3 times table. Products in the 3 times table are half of the products in the 6 times table. **Year 3 onwards**			3 x 4 = 6 x 2
When both factors are odd, the product is odd. When one factor is odd and the other factor is even, the product is even. (NCETM Year 3 unit 2.9) **Year 3 onwards**	1 × 7 = 7 (odd odd odd) 7 × 1 = 7 (odd odd odd) 2 × 7 = 14 (even odd even) 7 × 2 = 14 (odd even even) 3 × 7 = 21 (odd odd odd) 7 × 3 = 21 (odd odd odd) 4 × 7 = 28 (even odd even) 7 × 4 = 28 (odd even even)		odd x odd = odd odd x even = even even x odd = even even x even = even
Products in the 9 times table are triple the products in the 3 times table.	 9 x 4 1 x 4		3 x 12 = 9 x 4

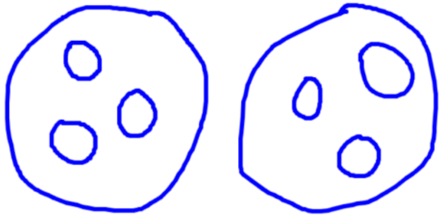
Products in the 10 times table can be used to find products in the 9 times table. (NCETM Year 3 unit 2.8) **Year 4 onwards**	 10 x 4		9 x 4 = 10 x 4 – 1 x 4
Products in the 10 times table can be used to find products in the 11 times table and 12 times table. **Year 4 onwards**			12 x 3 = 10 x 3 + 2 x 3 = 30 + 6 = 36

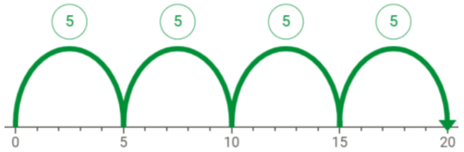
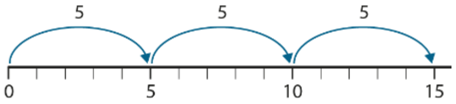
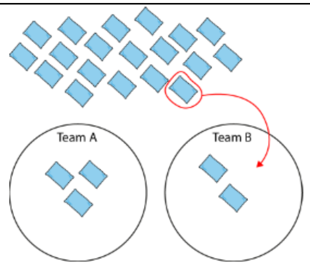
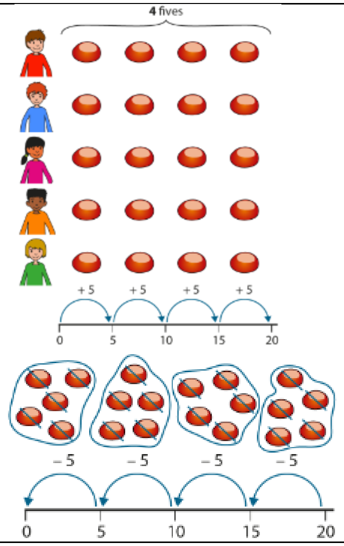
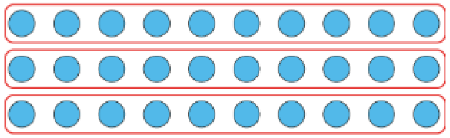
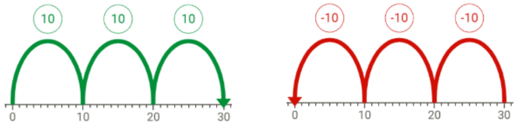
Calculation Policy: Division Guidance

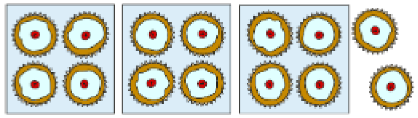
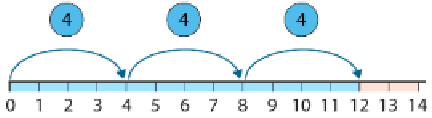
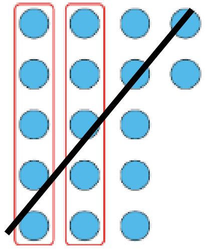
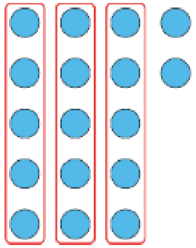
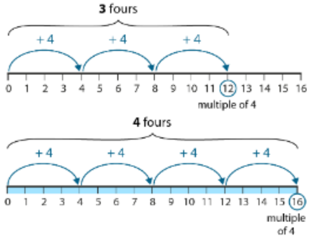
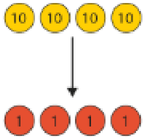
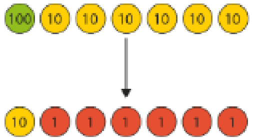
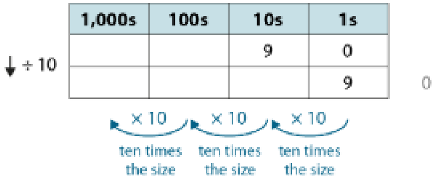
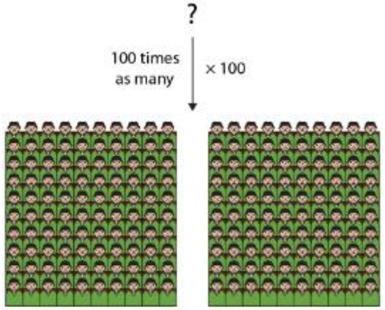
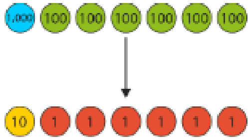
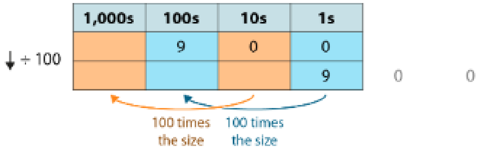
	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Division	ELG: solve problems, including halving and sharing	Sharing objects into groups	Division as grouping Division within arrays – linking to multiplication Repeated subtraction	Division with a remainder 2d divided by 1 d using base 10 or place value counters	Division with a remainder Short division (up to 3 digits by 1 digit – concrete and pictorial)	Short division (up to 4 digits by a 1 digit number including remainders)	Short division Long division with place value counters (up to 4 digits by a 2 digit) Children should exchange into the tenths and hundredths column too.

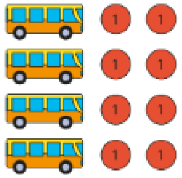
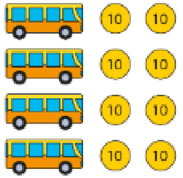
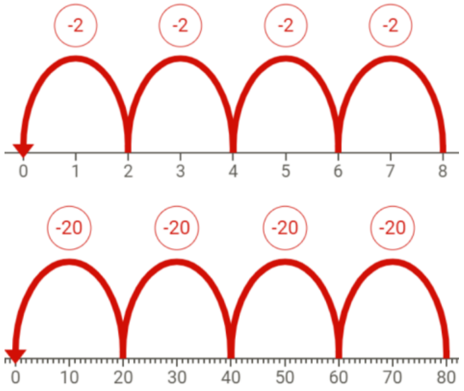
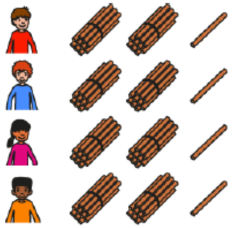
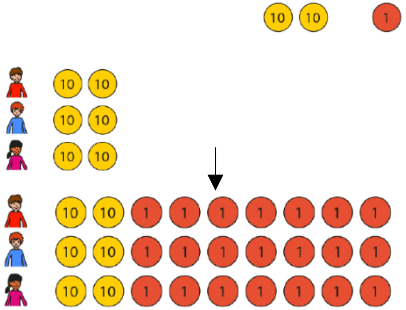
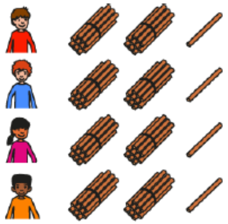
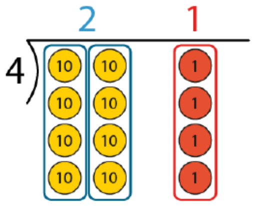
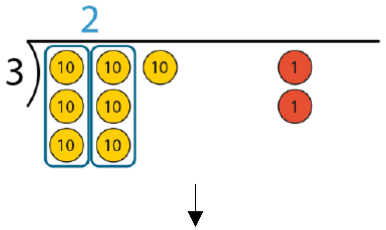
Calculation policy - Division
Key Language: halve, half, share, group, repeated subtraction, divide, divided by, divisor, dividend, quotient

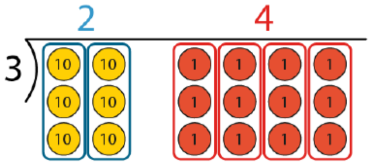
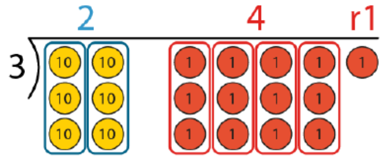
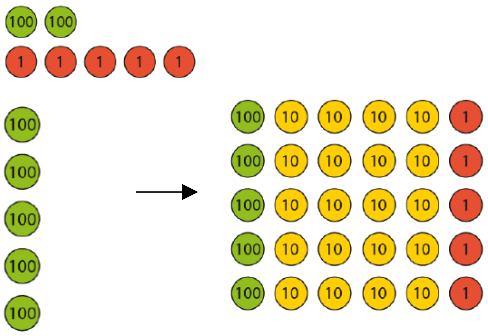
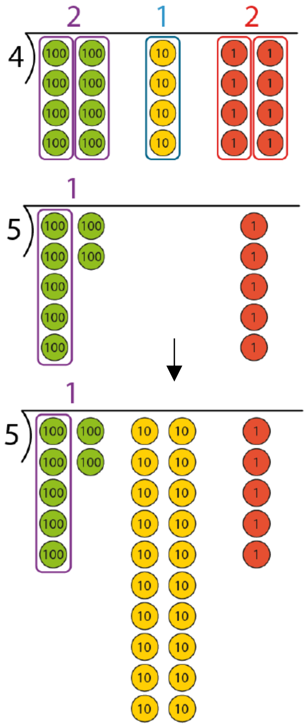
Division

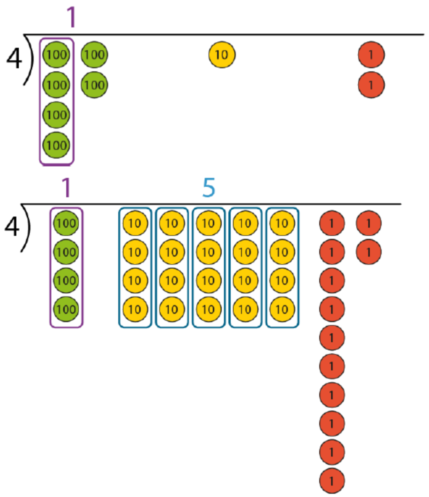
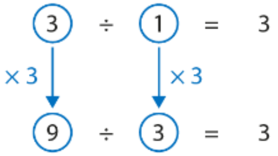
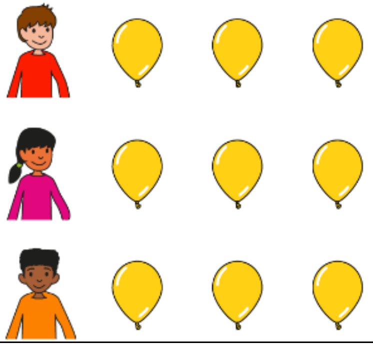
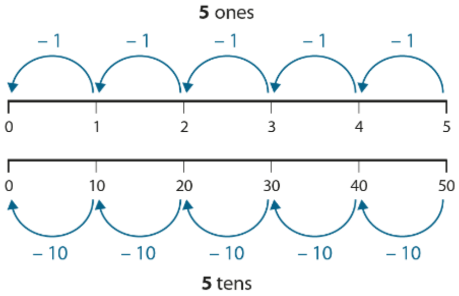
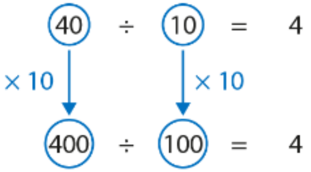
Stem sentences	Concrete (Can we make it?)	Pictorial (Can we draw it?)	Abstract (Can we write the equation?)
One group of two, two groups of two, three groups of 2, … Ten, twenty, thirty, … One five, two fives, three fives, … **Year R/1**			6 biscuits shared between 2 children gives 3 biscuits each.

The _____ costs __p. Each coin has a value of __p. So I need __ coins. **Year 1**			Five 2p coins = 10p
__ is divided into groups of __. There are __ groups. We can skip count using the divisor to find the quotient. **Year 2**			5 + 5 + 5 = 15 15 ÷ 5 = 3
__ divided between __ is equal to __ each. We can skip count using the divisor to find the quotient. **Year 2**			One 5 is 1 each. That's 5. Two 5s is 2 each. That's 10. 10 ÷ 5 = 2
Ten times __ is equal to __ so __ divided into groups of ten is __. If the divisor is __, we can use the __ times table to find the quotient. **Year 2**	30 represents the total number of counters. 10 represents the number in each group. 3 represents the number of groups.		10 x 3 = 30 3 x 10 = 30 30 ÷ 10 = 3

__ is divided into groups of __. There are __ groups and a remainder of __. (NCETM Year 4 unit 2.12) **Year 3**			14 = 4 x 3 + 2 14 ÷ 4 = 3 r 2
__ is a multiple of __ so when it is divided into groups of __, there is no remainder. The remainder is always less than the divisor. (NCETM Year 4 unit 2.12) **Year 3 or 4?**			17 ÷ 5 = 2 r 7 is incorrect because 7 is greater than 5. 17 ÷ 5 = 3 r 2
When dividing by 10 it will make the number 10 times smaller. **Year 4**	 4 tens ÷ 10 = 4 ones 40 ÷ 10 = 4		90 ÷ 10 = 9 150 ÷ 10 = 15
When dividing by 100 it will make the number 100 times smaller. **Year 4**	 ☐ × 100 = 200 200 ÷ 100 = ☐		900 ÷ 100 = 9 1500 ÷ 100 = 15

If the dividend is made ten times the size, the quotient will be ten times the size. **Year 4**	8 ÷ 4 = 2  80 ÷ 4 = 20 		$$\begin{tikzcd} 12 \arrow[d, "\times 10"'] & \div & 3 & = & 4 \arrow[d, "\times 10"] \\ 120 & \div & 3 & = & \boxed{40} \end{tikzcd}$$
If dividing the tens gives a remainder of one or more tens, we must exchange the remaining tens for ones. **Year 4**	 84 ÷ 4 = 21		8 tens ÷ 4 = 2 tens 4 ones ÷ 4 = 1 one 84 ÷ 4 = 21 6 tens ÷ 3 = 2 tens 21 ones ÷ 3 = 7 ones 81 ÷ 3 = 27
If dividing the tens gives a remainder of one or more tens, we must exchange the remaining tens for ones. **Year 4**		 72 ÷ 3 = 24 	10s 1s $\begin{array}{r} 2\;\;1 \\ 4\overline{)\,8\;\;4} \end{array}$ 8 tens ÷ 4 = 2 tens 4 ones ÷ 4 = 1 one $\begin{array}{r} 2\;\;1 \\ 4\overline{)\,8\;\;4} \end{array}$ $\begin{array}{r} 2\;\;4 \\ 3\overline{)\,7\;\;{}^{1}2} \end{array}$

		 73 ÷ 3 = 24 r 1 	2 4 r 1 3) 7 ^{1}3
If dividing the hundreds gives a remainder of one or more hundreds, we must exchange the remaining hundreds for tens. **Year 4**			2 1 2 4) 8 4 8 1 4 1 5) 7 ^{2}0 5

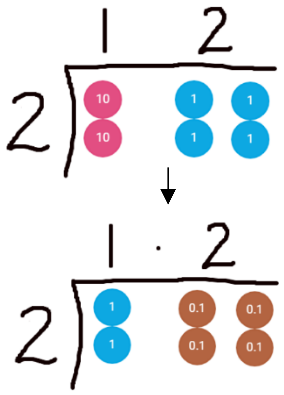
		612 ÷ 4 = 153 	
If there is a multiplicative change to the dividend factor and a corresponding change to the divisor, the quotient remains the same. If I multiply the dividend by __, I must multiply the divisor by __ for the quotient to remain the same. **Year 5 and 6**	  		

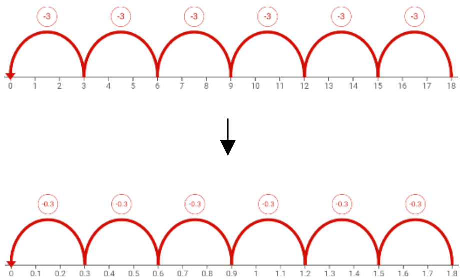
If the dividend is made one tenth of the size, the quotient will be one tenth of the size.

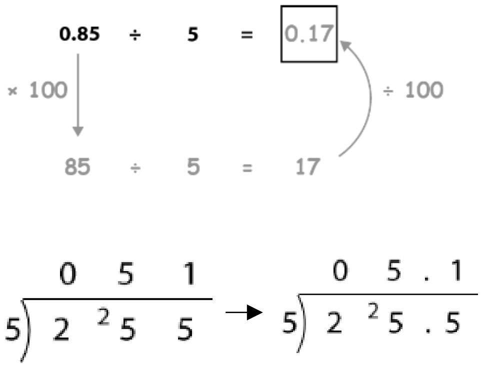
If the dividend is made one hundredth of the size, the quotient will be one hundredth of the size.

I move the digits of the dividend __ places to the left until I get a whole number; then I divide; then I move the digits of the quotient __ places to the right.

Year 5 onwards



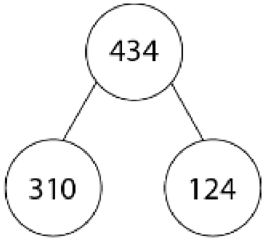




Any two-, three- or four-digit dividend can be divided by a two-digit divisor using skip-counting in multiples of the divisor, or by short division or long division.

Year 6

Partitioning



310 ÷ 31 = 10

124 ÷ 31 = 4

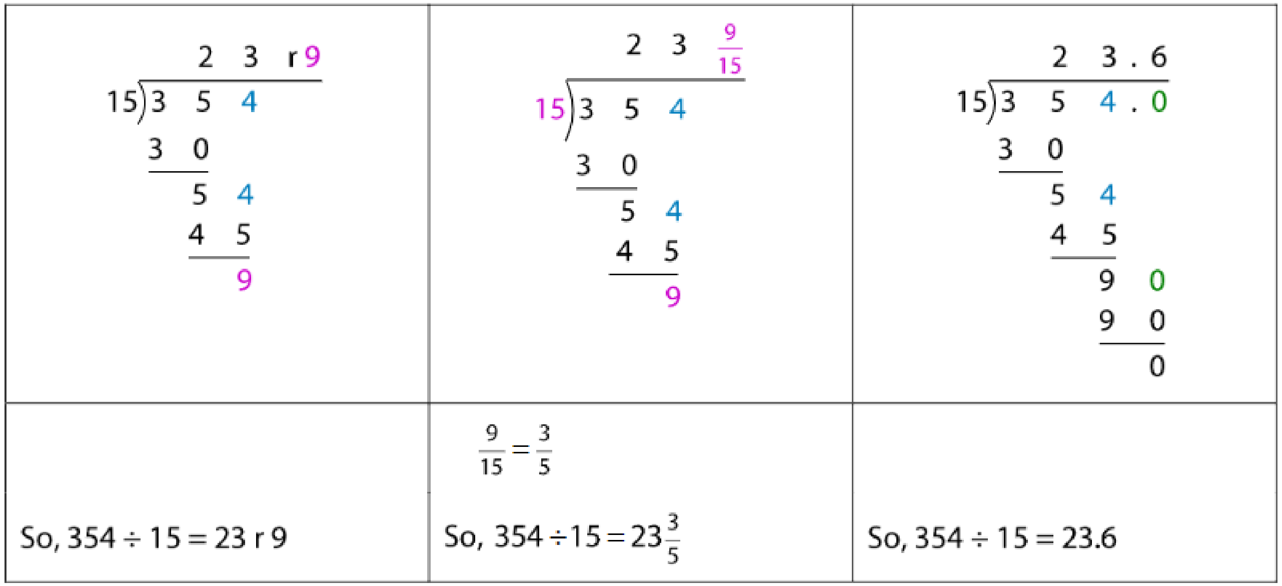
434 ÷ 31 = 14

Short division

$$\begin{array}{r} 0\ \ 1\ \ 4 \\ 31\overline{)4\ \ {}^{4}3\ \ {}^{12}4} \end{array}$$

Long division

$$\begin{array}{rl} \begin{array}{r} 0\ \ 1\ \ 4 \\ 31\overline{)4\ \ 3\ \ 4} \\ \underline{3\ \ 1}\ \ \ \ \\ 1\ \ 2\ \ 4 \\ \underline{1\ \ 2\ \ 4} \\ 0 \end{array} & \begin{array}{l} \\ \\ (1\,\text{ten} \times 31 = 31\,\text{tens}) \\ \\ (4\text{ ones} \times 31 = 124\text{ ones}) \\ \\ \end{array} \end{array}$$

Where there is a remainder, the result can be expressed as a whole-number quotient with a whole-number remainder, a whole-number quotient with a proper-fraction remainder, or as a decimal-fraction quotient. **Year 6**	$354 \div 15 = ?$  $\frac{9}{15} = \frac{3}{5}$ So, $354 \div 15 = 23$ r 9 So, $354 \div 15 = 23\frac{3}{5}$ So, $354 \div 15 = 23.6$

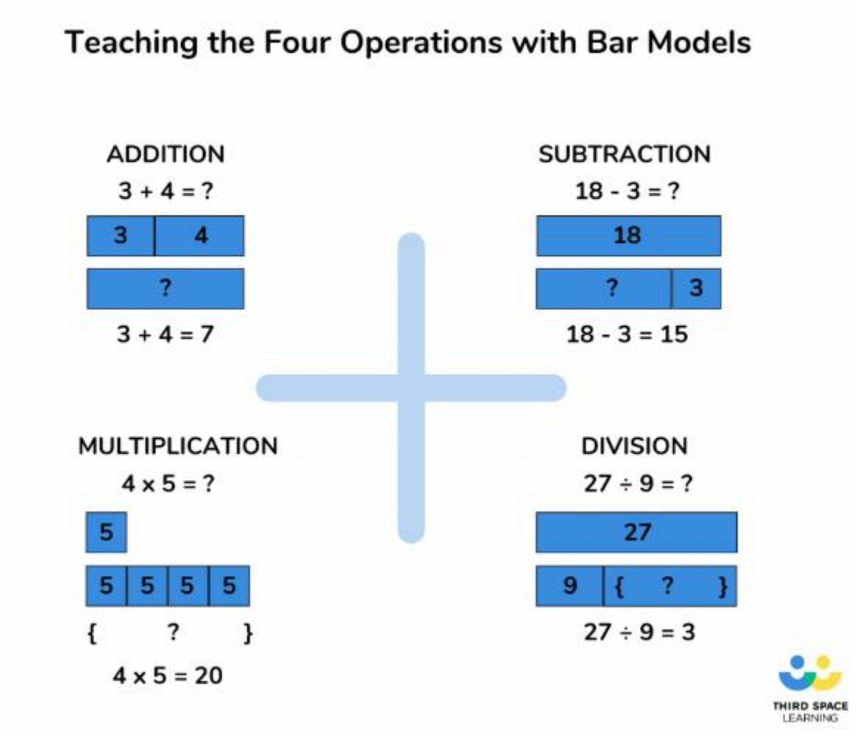
The Importance of Bar Modelling

A bar model is a pictorial representation of a problem or concept where bars or boxes are used to represent the known and unknown quantities. Bar models are most often used to solve number problems with the four operations.

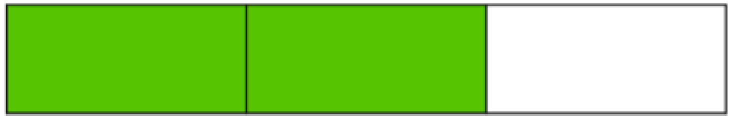
Because bar models only require pencils and paper, they are highly versatile and can come in very useful for tests, especially SATs Reasoning Papers.

However the use of bar models can begin much earlier, from showing number bonds to ten or partitioning numbers as part of your place value work.

Once a child is secure in their use of bar modelling for the four operations and can conceptualise its versatility, they can start to use it to visualise many other maths topics

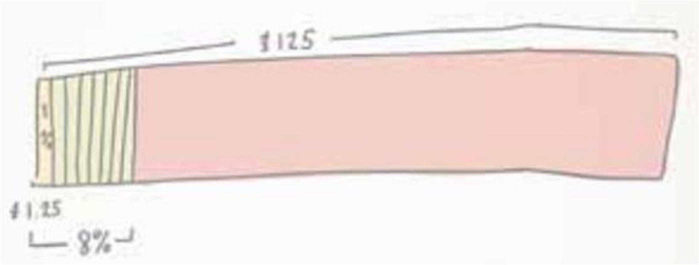


Bar models can be used in other areas of maths



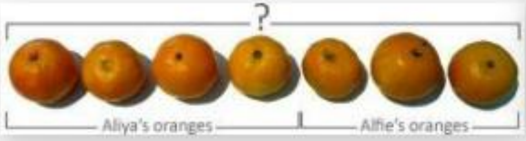
Sami has 12 balloons. $\frac{2}{3}$ of them are green. How many are green?

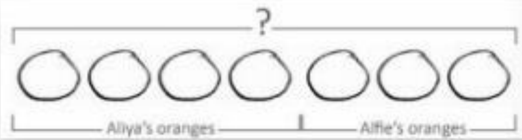
What is 8% of £125?

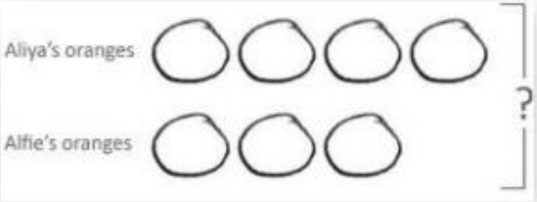


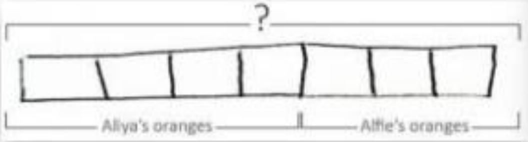
Problem Solving

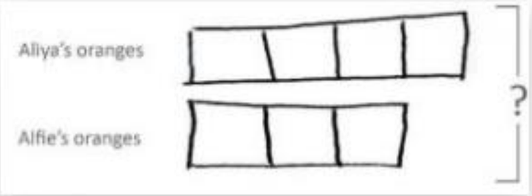
Aliya has 4 oranges. Alfie has 3 oranges. How many oranges are there altogether?

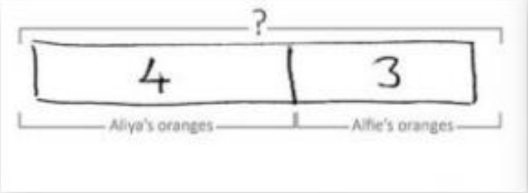


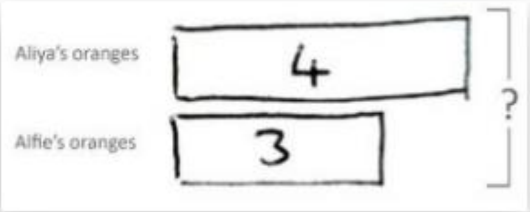




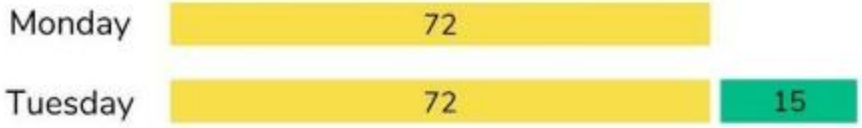






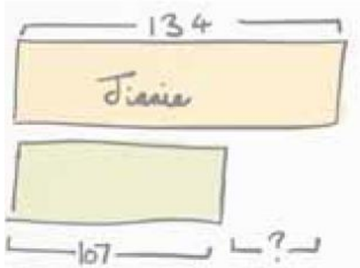


On Monday Lisa sold 72 chocolate bars. On Tuesday she sold 15 more than she sold on Monday. How many chocolate bars did she sell altogether?



72 + 72 + 15 = 159 chocolate bars

Jinnie is 134cm tall. Her sister is 107cm tall.
How much taller is Jinnie than her sister?

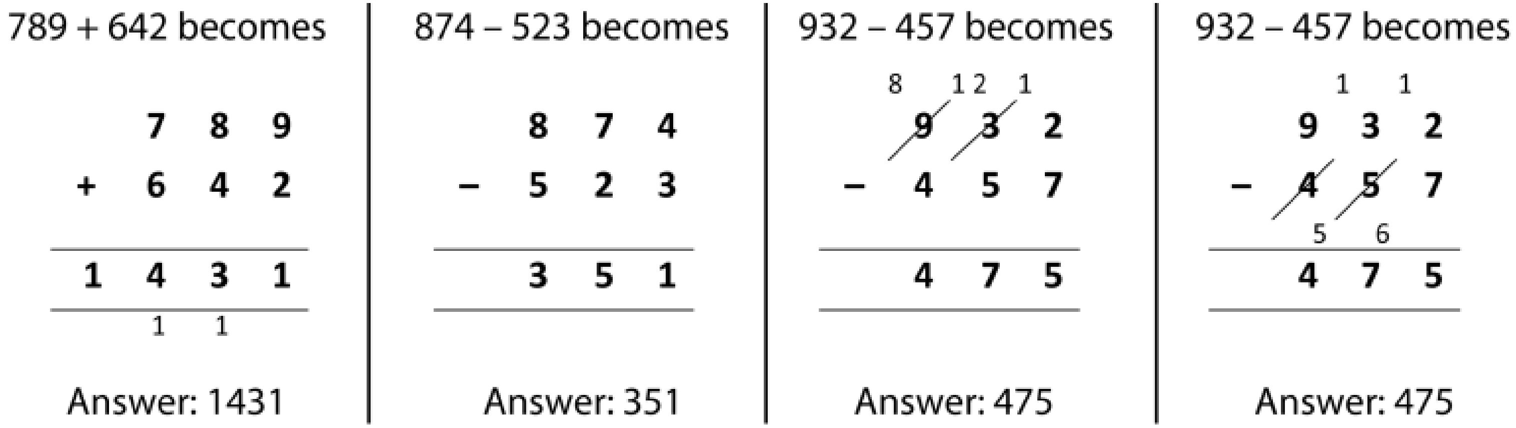


National Curriculum

Mathematics Appendix 1: Examples of formal written methods for addition, subtraction, multiplication and division

This appendix sets out some examples of formal written methods for all four operations to illustrate the range of methods that could be taught. It is not intended to be an exhaustive list, nor is it intended to show progression in formal written methods. For example, the exact position of intermediate calculations (superscript and subscript digits) will vary depending on the method and format used.

Addition and subtraction



789 + 642 becomes

$$\begin{array}{rrrr} & 7 & 8 & 9 \\ + & 6 & 4 & 2 \\ \hline 1 & 4 & 3 & 1 \\ \hline & {}_{1} & {}_{1} & \end{array}$$

Answer: 1431

874 – 523 becomes

$$\begin{array}{rrrr} & 8 & 7 & 4 \\ - & 5 & 2 & 3 \\ \hline & 3 & 5 & 1 \\ \hline \end{array}$$

Answer: 351

932 – 457 becomes

$$\begin{array}{rrrr} & \overset{8}{\cancel{9}} & \overset{12}{\cancel{3}} & \overset{1}{2} \\ - & 4 & 5 & 7 \\ \hline & 4 & 7 & 5 \\ \hline \end{array}$$

Answer: 475

932 – 457 becomes

$$\begin{array}{rrrr} & 9 & \overset{1}{3} & \overset{1}{2} \\ - & \underset{5}{\cancel{4}} & \underset{6}{\cancel{5}} & 7 \\ \hline & 4 & 7 & 5 \\ \hline \end{array}$$

Answer: 475

Short multiplication

24 × 6 becomes

$$\begin{array}{ccc} & 2 & 4\\ \times & & 6\\ \hline 1 & 4 & 4\\ \hline & {\scriptstyle 2} & \end{array}$$

Answer: 144

342 × 7 becomes

$$\begin{array}{cccc} & 3 & 4 & 2\\ \times & & & 7\\ \hline 2 & 3 & 9 & 4\\ \hline & {\scriptstyle 2} & {\scriptstyle 1} & \end{array}$$

Answer: 2394

2741 × 6 becomes

$$\begin{array}{ccccc} & 2 & 7 & 4 & 1\\ \times & & & & 6\\ \hline 1 & 6 & 4 & 4 & 6\\ \hline & {\scriptstyle 4} & {\scriptstyle 2} & & \end{array}$$

Answer: 16 446

Long multiplication

24 × 16 becomes

$$\begin{array}{ccc} & {\scriptstyle 2} & \\ & 2 & 4\\ \times & 1 & 6\\ \hline 2 & 4 & 0\\ 1 & 4 & 4\\ \hline 3 & 8 & 4\\ \hline \end{array}$$

Answer: 384

124 × 26 becomes

$$\begin{array}{cccc} & {\scriptstyle 1} & {\scriptstyle 2} & \\ & 1 & 2 & 4\\ \times & & 2 & 6\\ \hline 2 & 4 & 8 & 0\\ & 7 & 4 & 4\\ \hline 3 & 2 & 2 & 4\\ \hline {\scriptstyle 1} & {\scriptstyle 1} & & \end{array}$$

Answer: 3224

124 × 26 becomes

$$\begin{array}{cccc} & {\scriptstyle 1} & {\scriptstyle 2} & \\ & 1 & 2 & 4\\ \times & & 2 & 6\\ \hline & 7 & 4 & 4\\ 2 & 4 & 8 & 0\\ \hline 3 & 2 & 2 & 4\\ \hline {\scriptstyle 1} & {\scriptstyle 1} & & \end{array}$$

Answer: 3224

Short division

98 ÷ 7 becomes

$$\begin{array}{r|ll} \multicolumn{1}{r}{} & 1 & 4 \\ \cline{2-3} 7 & 9 & {}^{2}8 \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r|llll} \multicolumn{1}{r}{} & & 8 & 6 & r\,2 \\ \cline{2-4} 5 & 4 & 3 & {}^{3}2 & \end{array}$$

Answer: 86 remainder 2

496 ÷ 11 becomes

$$\begin{array}{r|llll} \multicolumn{1}{r}{} & & 4 & 5 & r\,1 \\ \cline{2-5} 11 & 4 & 9 & {}^{5}6 & \end{array}$$

Answer: $45\frac{1}{11}$

Long division

432 ÷ 15 becomes

$$\begin{array}{r|rrrl} \multicolumn{1}{r}{} & & 2 & 8 & r\,12 \\ \cline{2-4} 15 & 4 & 3 & 2 & \\ \multicolumn{1}{r}{} & 3 & 0 & 0 & \\ \cline{2-4} \multicolumn{1}{r}{} & 1 & 3 & 2 & \\ \multicolumn{1}{r}{} & 1 & 2 & 0 & \\ \cline{2-4} \multicolumn{1}{r}{} & & 1 & 2 & \end{array}$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$\begin{array}{r|rrrl} \multicolumn{1}{r}{} & & 2 & 8 & \\ \cline{2-4} 15 & 4 & 3 & 2 & \\ \multicolumn{1}{r}{} & 3 & 0 & 0 & 15\times20 \\ \cline{2-4} \multicolumn{1}{r}{} & 1 & 3 & 2 & \\ \multicolumn{1}{r}{} & 1 & 2 & 0 & 15\times8 \\ \cline{2-4} \multicolumn{1}{r}{} & & 1 & 2 & \end{array}$$

$$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$$

Answer: $28\frac{4}{5}$

432 ÷ 15 becomes

$$\begin{array}{r|rrrcr} \multicolumn{1}{r}{} & & 2 & 8 & \cdot & 8 \\ \cline{2-6} 15 & 4 & 3 & 2 & \cdot & 0 \\ \multicolumn{1}{r}{} & 3 & 0 & \downarrow & & \downarrow \\ \cline{2-3} \multicolumn{1}{r}{} & 1 & 3 & 2 & & \\ \multicolumn{1}{r}{} & 1 & 2 & 0 & & \downarrow \\ \cline{2-4} \multicolumn{1}{r}{} & & 1 & 2 & & 0 \\ \multicolumn{1}{r}{} & & 1 & 2 & & 0 \\ \cline{3-6} \multicolumn{1}{r}{} & & & & & 0 \end{array}$$

Answer: 28·8