Academies Trust

Calculation Policy

Mathematics

Co–op Academy Nightingale

Academies Trust

Progression Towards a Standard Written Method of Calculation

Introduction:

This calculation policy has been written in line with the programmes of study taken from the National Curriculum and the White Rose Maths Scheme used at Co-op Academy Nightingale for mathematics. This calculation policy has been devised to support academies in understanding both the expectations for fluency of the national curriculum and the progression of calculation concepts through a child's mathematical development.

Principles:

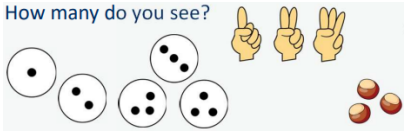
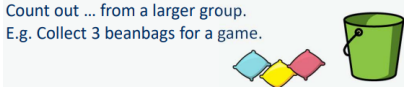
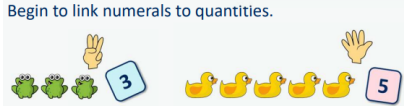
- This policy focuses on developing proficiency with the expected formal written methods by the end of Key Stage 2 and hence the progression guidance provided for each operation is designed to flow into the expected method as exemplified on the National Curriculum Appendix document (see page 6 for a summary of these).
- It aims to ensure that children can use these methods accurately with confidence and understanding.
- Specific practical equipment and pictorial representations have been suggested to ensure children develop a conceptual understanding to enable them to progress towards the expected formal written methods.
- Children are encouraged to complete calculations using concrete and pictorial representations alongside recording the relevant formal written method.
- Whilst teachers work towards the fluency goals for each year group, if children present gaps in knowledge and understanding, teachers will use materials from earlier year groups to bridge gaps in understanding.
- Teachers should have an understanding of the expectations and progression for all year groups, regardless of which year group they teach.

Representations:

The key to successful implementation of a calculation policy is the consistent use of representations (concrete and pictorial representations that support conceptual understanding of mathematics) and this policy promotes a range of relevant representations, across the primary years.

Mathematical understanding is developed through use of representations that are first concrete (e.g. Dienes apparatus, cubes), then pictorial (e.g. array, place value counters), finally to then facilitate abstract working (e.g. column addition, long multiplication).

This policy guides teachers through an appropriate progression of representations, and if at any point a pupil is struggling, they should revert to familiar pictorial and/or concrete materials/ representations as appropriate.

Nursery	Addition	Subtraction	Multiplication	Division
	Subitise to 3   **Count How many**   **Make numbers to 5**   **Add 1 more** 	**Take 1 away**  		

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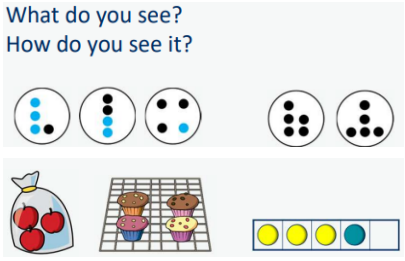
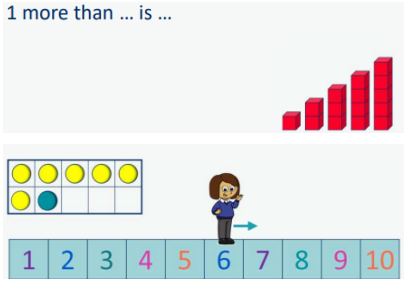
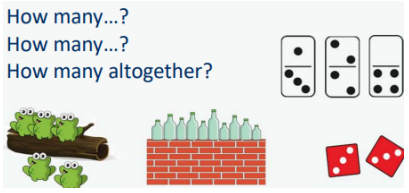
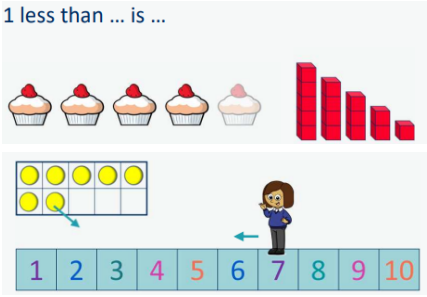
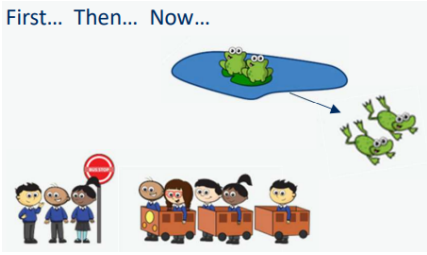
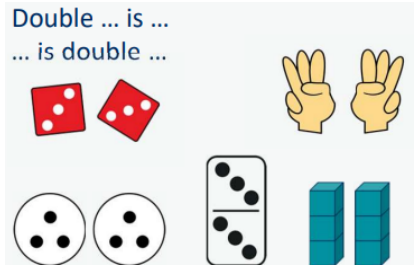
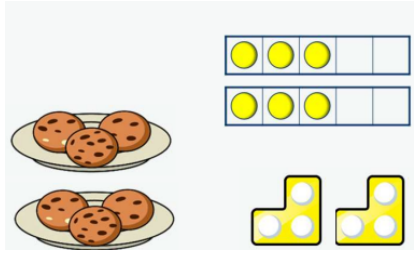
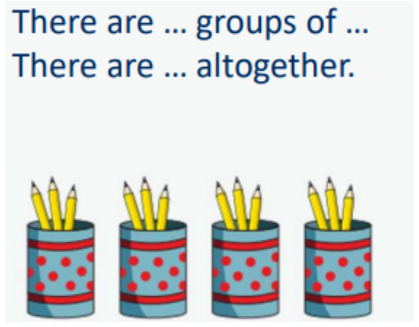
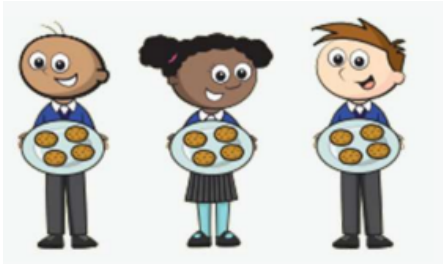
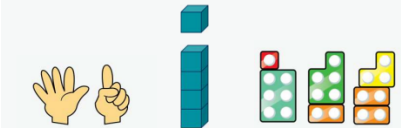
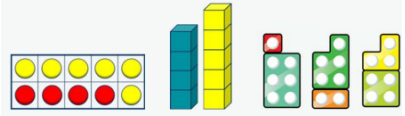
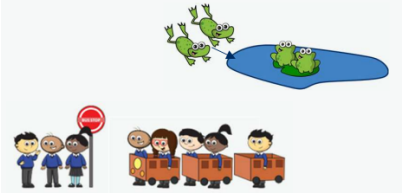
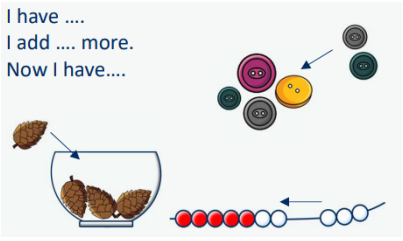
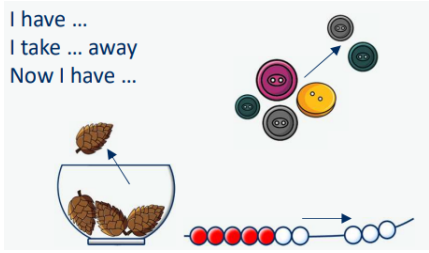
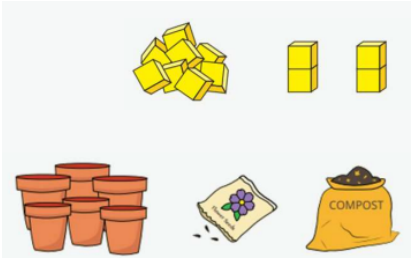
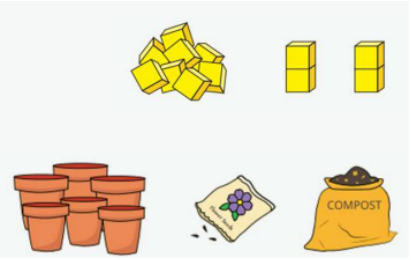
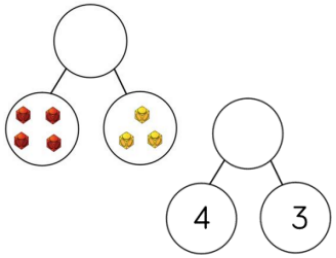
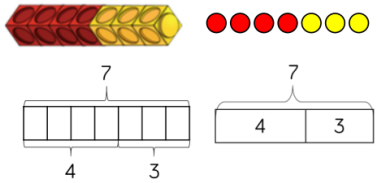
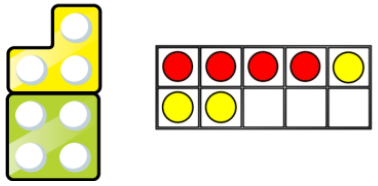
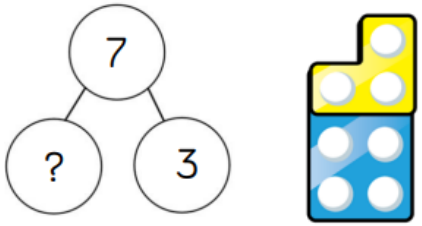
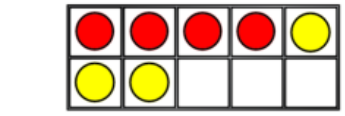
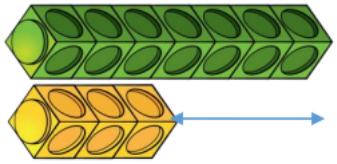
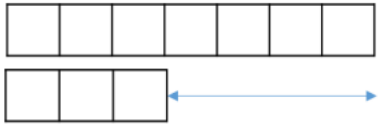
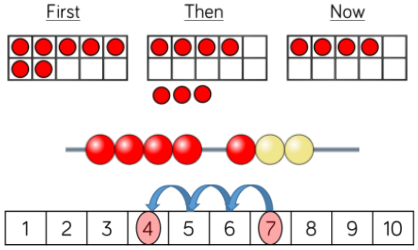
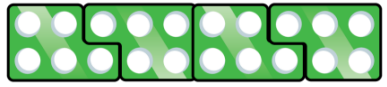
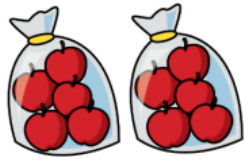
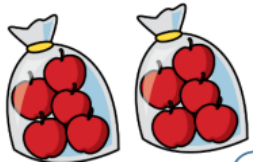
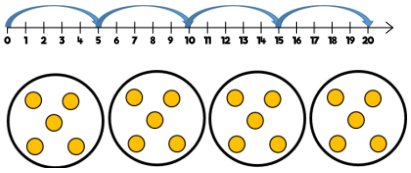
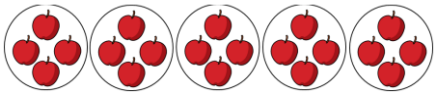
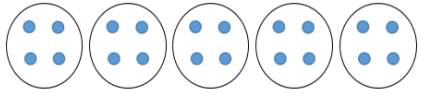
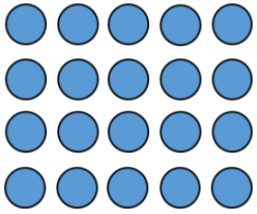
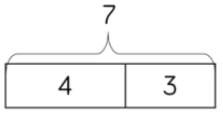
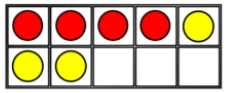
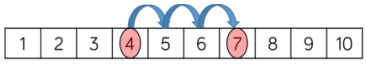
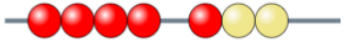
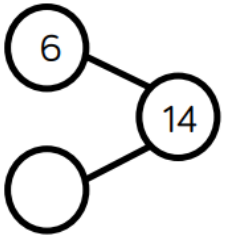
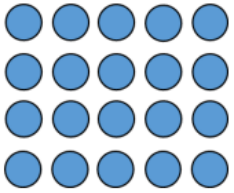
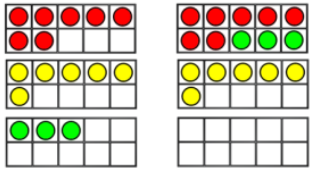
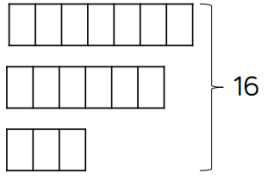
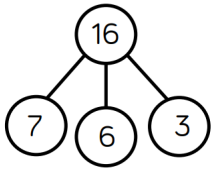
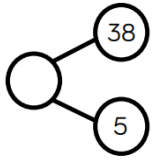
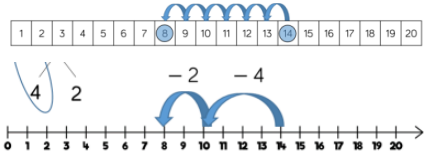
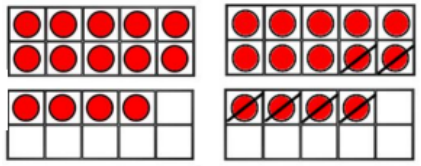
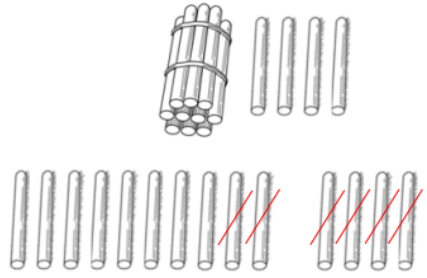
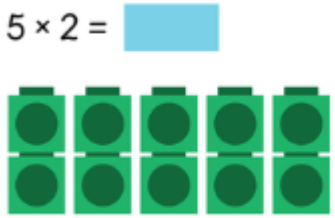
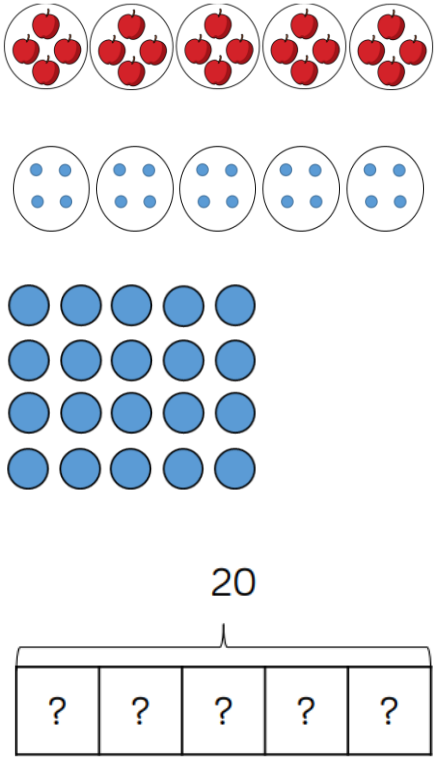
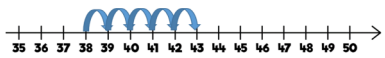
Reception	Addition	Subtraction	Multiplication	Division
	Subitise to 5  **1 more**  **Notice the composition of numbers within 10** 	**1 less**  **Partition**  **Take away** 	**Double to 10**   **Make equal groups** 	**Sharing**   **Grouping** 

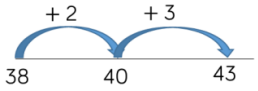
	How many ways can you make...?  **Combine 2 groups** There are .... There are .... There are .... altogether.   .... and .... make ....  **Add more** First... Then.... Now....  I have .... I add .... more. Now I have.... 	I have ... I take ... away Now I have ... 	 	

Year 1	Addition	Subtraction	Multiplication	Division
Representation (concrete or pictorial)	**Aggregation** (combining 2 or more parts) - part-whole model - bar model - number shapes - ten frame    **Augmentation** (increasing a quantity by adding more to it)	    	In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record multiplication formally     	In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally.   

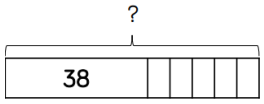
	-bar model - ten frame - bead string - number track     			
Abstract	$4 + 3 = 7$ 6 and ▭ is equal to 9. 6 + ▭ = 9 9 = 6 + ▭	$7 - 3 = 4$ (a) 8 − 0 = ☐ (b) 6 − 5 = ☐ (c) 10 − 9 = ☐ (d) 3 − 3 = ☐ Sam took 3 drinks out of a new box. How many drinks are left in the box? ☐ − ☐ = ☐ ☐ frogs are eating flies. ☐ − ☐ = ☐ ☐ birds are flying away. ☐ − ☐ = ☐ ☐ dragonflies are on the flowers.	$5 + 5 + 5 + 5 = 20$ Count in multiples of a number One bag holds 5 apples. How many apples do 4 bags hold?	Oak puts 6 books equally into 3 bags. How many books are in each bag?  ▭ books are in each bag. There are 20 apples altogether. They are put in bags of 5. How many bags are there?

Year 2	Addition	Subtraction	Multiplication *Children should know 2s, 5s and 10s by the end of year 2.*	Division
Representation (concrete or pictorial)	From Year 2, exchanging is introduced (crossing ten in year 1 is taught through counting on. **Adding three 1-digit numbers**    **Adding a 1-digit and 2-digit numbers**  	In Year 1, subtracting one-digit numbers that cross 10, is done by counting back, using objects, number tracks and number lines. From Year 2, children should be encouraged to find the number bond to 10 when partitioning the subtracted number. Ten frames, number shapes and number lines are particularly useful for this. **Subtract 1 and 2-digit numbers**   	In Year 2, children are introduced to the multiplication symbol.   	In Year 2, children are introduced to the division symbol. 

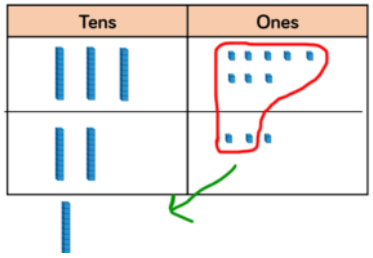


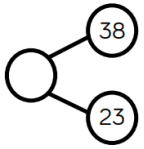


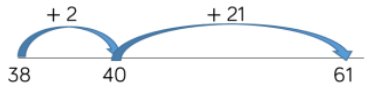
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

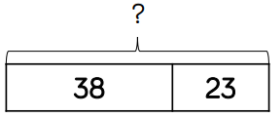


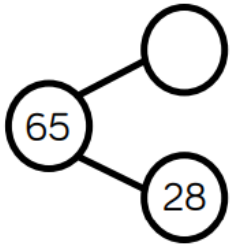
Adding two 2-digit numbers

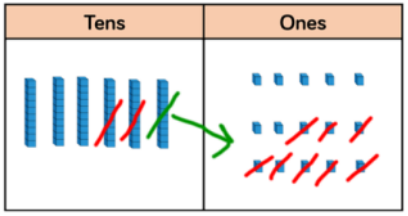


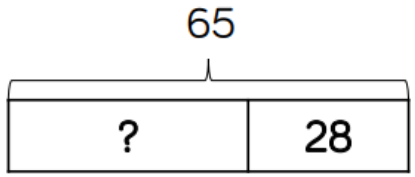


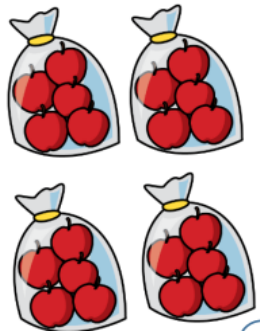


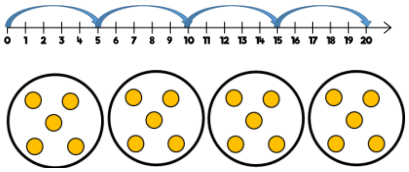


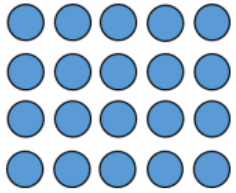












Abstract
Begin to use formal written methods for addition and subtraction (column method)

$8 + 7 = 15$

$2 \quad 5$

$7 + 6 + 3 = 16$

10

Add.

(a)

	tens	ones
	3	4
+		7

$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

$38 + 23 = 61$

$14 - 6 = 8$

$4 \quad 2$

$$\begin{array}{r} {}^{5}\cancel{6}{}^{1}5 \\ -\ 28 \\ \hline 37 \\ \hline \end{array}$$

(a) $86 - 35 =$ ☐

(b) $97 - 64 =$ ☐

1 group of 2
$1 \times 2 = 2$

2 groups of 2
$2 \times 2 = 4$

3 groups of 2
$3 \times 2 = 6$

4 groups of 2
$4 \times 2 = 8$

$1 \times 2 =$ ☐ $\quad 6 \times 2 =$ ☐

$2 \times 2 =$ ☐ $\quad 7 \times 2 =$ ☐

$5 + 5 + 5 + 5 = 20$

$4 \times 5 = 20$

$5 \times 4 = 20$

There are 20 apples altogether.
They are put in bags of 5.
How many bags are there?

$20 \div 5 = 4$

(a) $10 \div 5 =$ ☐

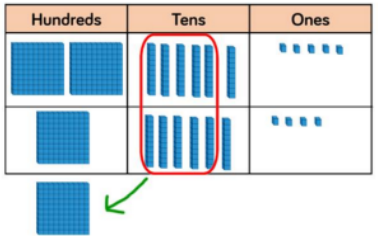
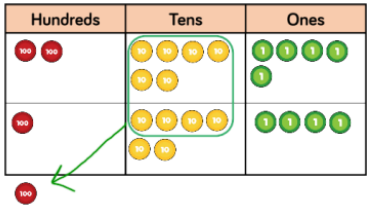
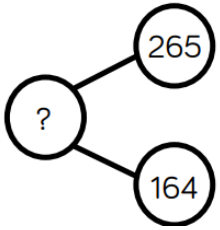
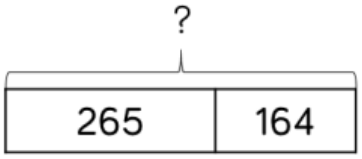
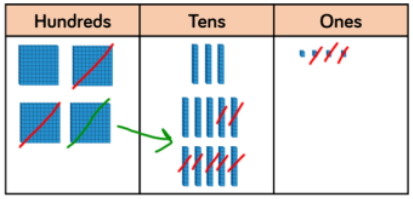
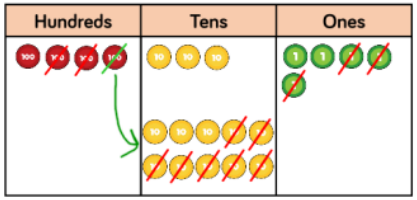
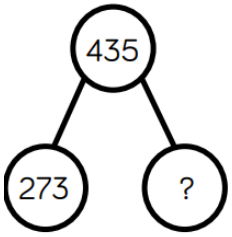
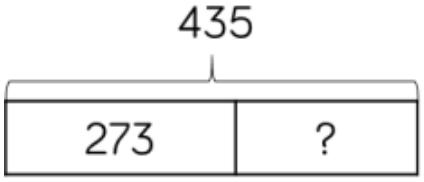
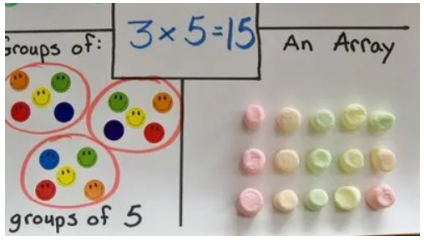
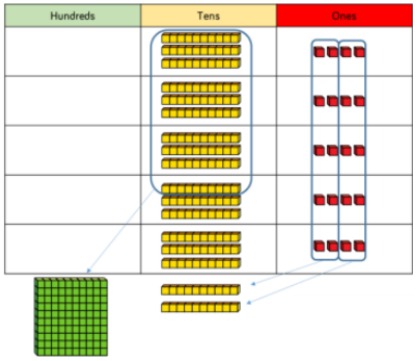
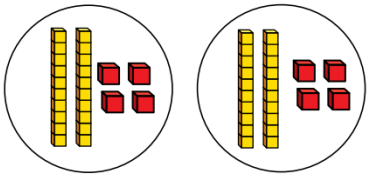
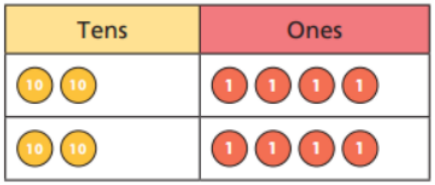
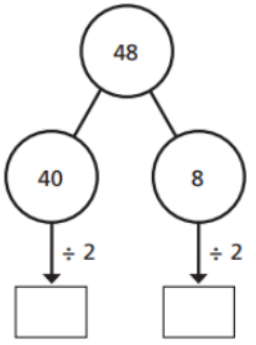
☐ $\times 5 = 10$

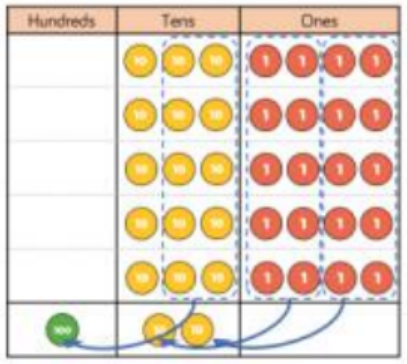
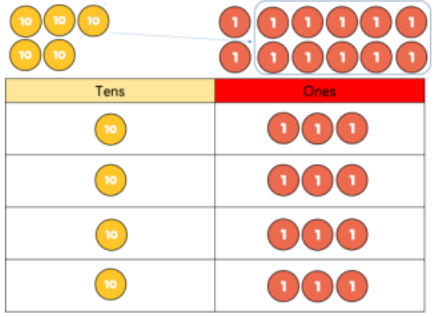
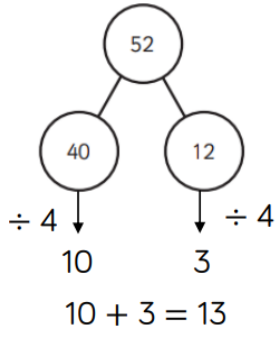
(c) $20 \div 5 =$ ☐

☐ $\times 5 = 20$

(a) $25 \div 5 =$ ☐

(c) $45 \div 5 =$ ☐

Year 3	Addition	Subtraction	Multiplication *Children should know 3s, 4s and 8s by the end of Year 3.*	Division
Representation (concrete or pictorial)	**Add numbers with up to 3-digits**     	**Subtract numbers with up to 3-digits**     	Children do not need to learn the formal multiplication method in year 3 **Times tables**  **Multiplying a 2-digit number by a 1-digit number**  	Children do not need to learn the formal division method in year 3 **Divide 2-digits by 1-digit (sharing with no exchange)**    **Divide 2 or 3-digits by 1-digit (sharing**

				**with exchange)**   

Abstract

Begin to use formal written methods for addition and subtraction (column method)

$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

215 + 42 = ☐

412 + 267 = ☐

7 people joined a group of 345 people at a fun run.
How many people were at the fun run in total?

	h	t	o
	~~4~~	~~10~~	~~0~~ 7
−	1	4	3
	3	6	4

$$\begin{array}{r} {}^{3}\,{}^{1}435 \\ -\ 273 \\ \hline 162 \\ \hline \end{array}$$

200 − 45 = ☐

400 − 234 = ☐

34 × 5 = 170

A tricycle has 3 wheels.
How many wheels are on 6 tricycles?

☐ × ☐ = ☐

Find the product of:

(a) 14 and 2 ☐

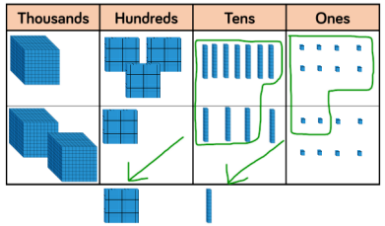
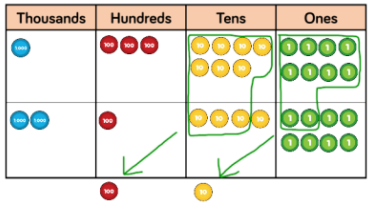
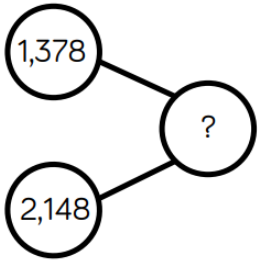
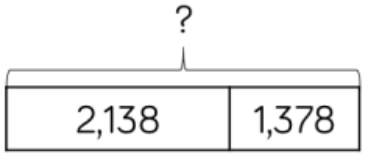
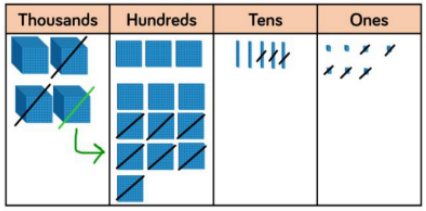
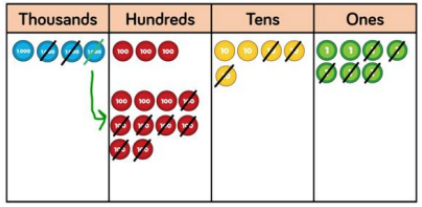
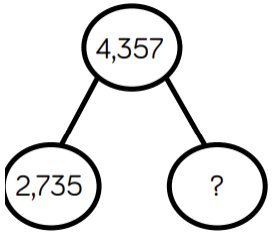
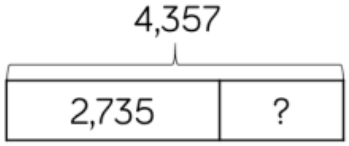
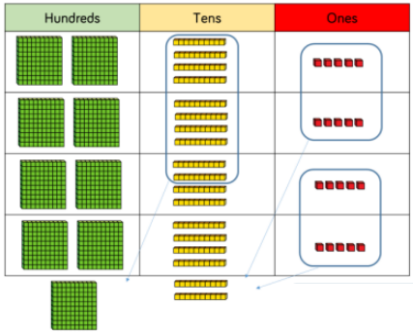
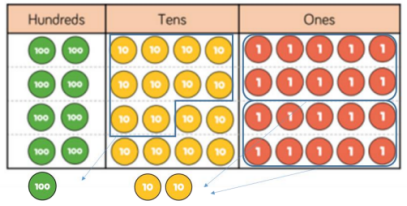
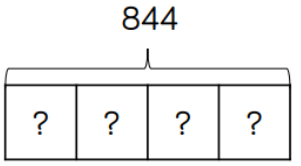
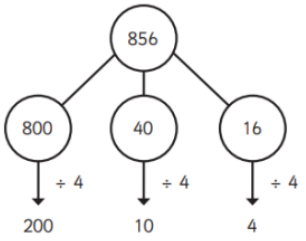
(b) 3 and 22 ☐

(c) 3 and 31 ☐

48 ÷ 2 = 24

52 ÷ 4 = 13

53 ÷ 4 = 13 r1

Year 4	Addition	Subtraction	Multiplication *Children should know all times tables up to 12x12 by the end of year 4 in readiness for their multiplication check.*	Division
Representation (concrete or pictorial)	**Add numbers with up to 4 digits**     	**Subtract numbers with up to 4 digits**     	Children progress to formal multiplication in year 4 **Multiplying 3 by 1-digit numbers**   	Children progress to formal division in year 5 **Divide 3-digits by 1-digit**  

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Abstract

Formal written methods to be used for addition, subtraction and multiplication.

	1	3	7	8
+	2	1	4	8
	3	5	2	6

1 1

Last year, 3657 pupils enrolled in Charleston School.
This year, 2765 pupils enrolled in the school.
How many pupils enrolled in the school in these two years altogether?

3 1
4357
− 2735
1622

4792 people were inside a stadium for a tennis match.
During the interval, 1391 went outside the stadium to get a drink.
How many people were left inside the stadium during the interval?

	H	T	O	
		3	4	
×			5	
	1	7	0	

1 2

	H	T	O
	2	4	5
×			4
	9	8	0

1 2

396 ÷3 = 132

258 ÷3 = 86

357 ÷ 5 = 71r2

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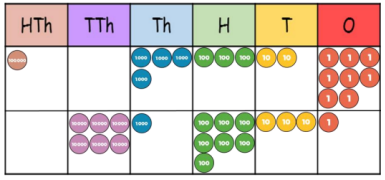
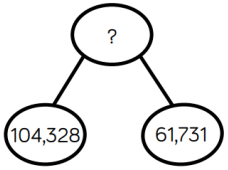
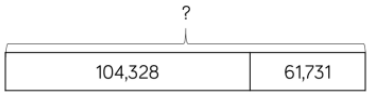
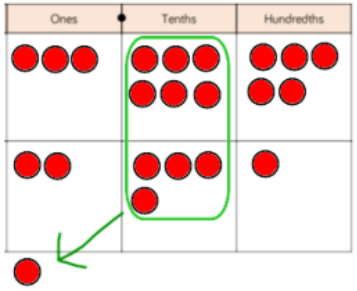
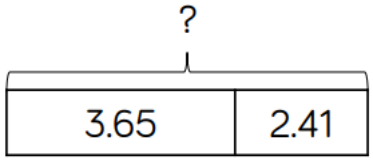
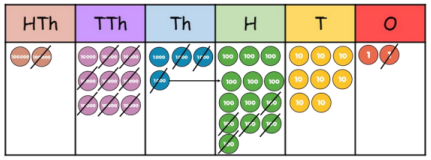
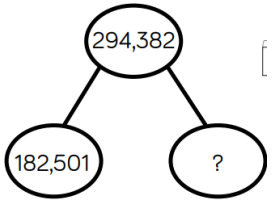
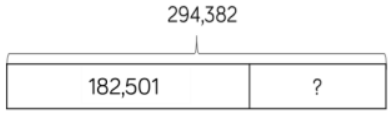
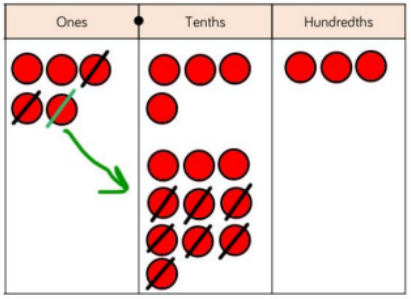
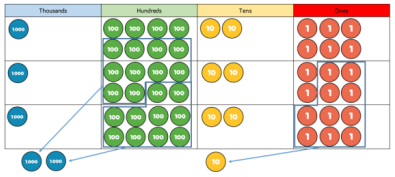
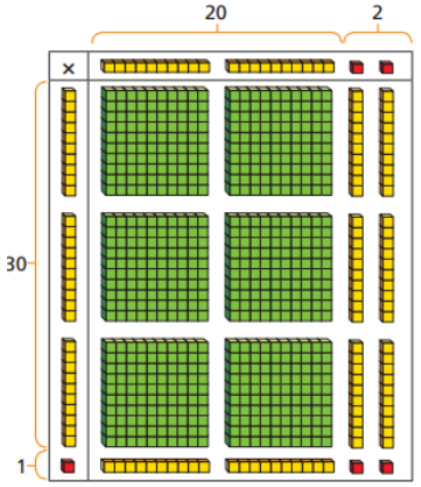
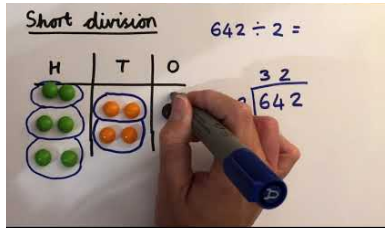
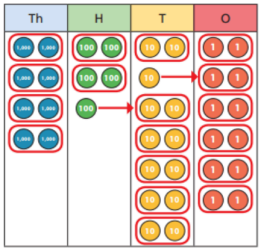
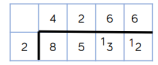
Year 5	Addition	Subtraction	Multiplication	Division
Representation (concrete or pictorial)	**Add numbers with more than 4 digits**    **Add numbers with up to 3 decimal places**   	**Subtract numbers with more than 4 digits**    **Subtract numbers with up to 3 decimal places**  	**Multiplying 4-digit numbers by 1-digit numbers**  **Multiplying 2-digit numbers by 2-digit numbers**  	Children progress onto formal division methods **Divide up to 4-digits by 1-digit**   

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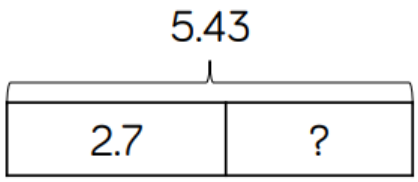

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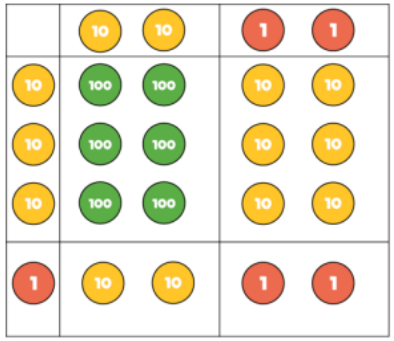
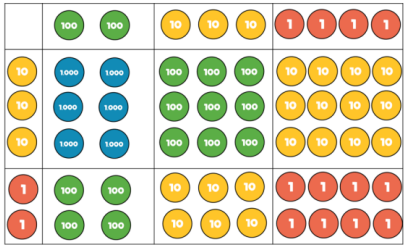


Multiply 3-digit numbers by 2-digit numbers


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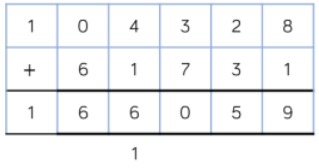
<td>Abstract

Formal written methods to be used.</td>
<td>


3.65
+ 2.41
6.06
1
</td>
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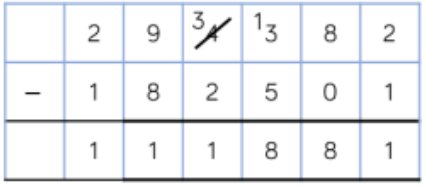

4 1
5.43
– 2.7
2.73
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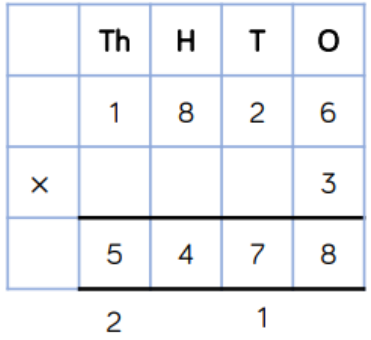

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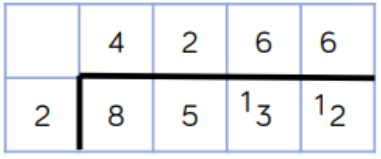

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</table>

The table shows the amount of money made from selling refreshments at the football event. Find the total value of the sales.

Refreshments	Sales
food	£95 000
drinks	£76 000

$$\begin{array}{r} 95\,000 \\ +\,76\,000 \\ \hline \end{array}$$

Find the difference between the number of runners in these marathons.

(a) London and Los Angeles

42 270 − 26 260 = ____

(b) Tokyo and Rome

36 000 − 13 700 = ____

×	20	2
30	600	60
1	20	2

	H	T	O
		2	2
×		3	1
		2	2
	6	6	0
	6	8	2

×	200	30	4
30	6,000	900	120
2	400	60	8

Th	H	T	O
	2	3	4
×		3	2
	4	6	8
$^{1}7$	$^{1}0$	2	0
7	4	8	8

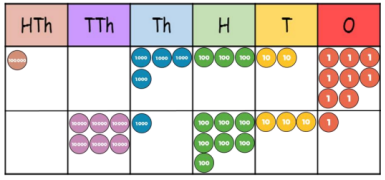
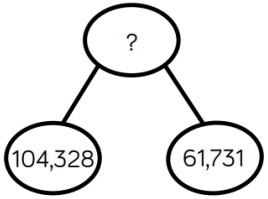
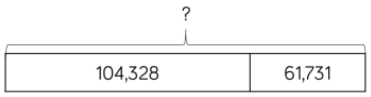
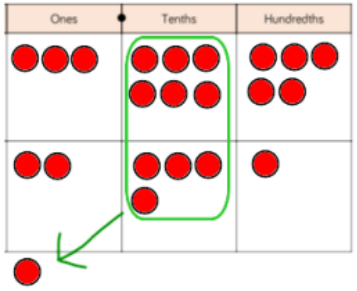
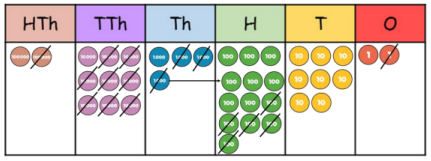
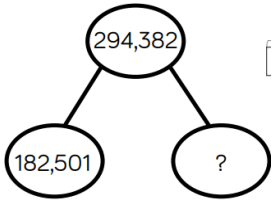
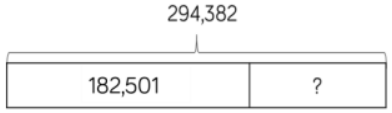
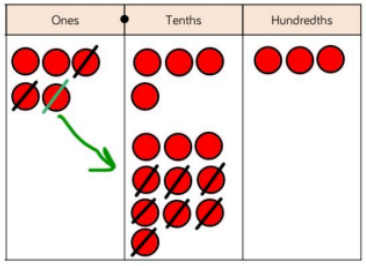
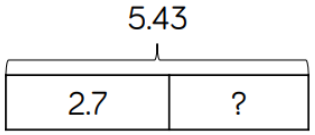
Begin with divisions that divide equally with no remainder.

$$\begin{array}{r} 218 \\ 3 \overline{)\,872} \end{array}$$

Move onto divisions with a remainder.

$$\begin{array}{r} 86\ r\ 2 \\ 3 \overline{)\,432} \end{array}$$

Lulu's school raised £1968 for charity.
The school shared the money equally between 6 charities.
How much did each of the charities receive?

Year 6	Addition	Subtraction	Multiplication	Division
Representation (concrete or pictorial)	**Add numbers with more than 4 digits**    **Add decimals**  	**Subtract numbers with more than 4 digits**    **Subtract decimals**   	**Multiplying 4-digit numbers by 2-digit numbers** Before moving onto 4-digit numbers multiplied by 2-digit numbers, children should be confident with the formal method. If not, take a step back using representation (see year 5) before progressing onto this.	**Divide multi digits by 1-digit (short division)** Before moving onto multiple digit numbers divided by 1 digit, children should be confident with the formal method. If not, take a step back using representation (see year 5) before progressing onto this. **Divide multi-digits by 2-digits (long division)**

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Abstract

Formal written methods to be used.

1. 568337 + 441053 2. 686410 + 283660 3. 921956 + 177423

1. _____ + 91 + 5623 + 911 = 6630

2. 38 + 58 + 8798 + _____ = 9543

3. _____ + 1297 + 26 + 17 = 2011

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

1

$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

578101 - 194129 909259 - 255629 754629 - 298374 466734 - 372741

742837 - 285841 456139 - 341689 781168 - 650368 836551 - 378159

	2	9	$^{3}\not{4}$	$^{1}3$	8	2
–	1	8	2	5	0	1
	1	1	1	8	8	1

$$\begin{array}{r} {}^{4}\not{5}.{}^{1}43 \\ -\ 2.7 \\ \hline 2.73 \end{array}$$

Estimate the difference between 382 255 and 203 146.
Then, find the actual answer.

382 255
– 203 146

Is your estimate close to your actual answer?

The number of visitors to Brighton during one weekend was 75 580.
Due to the Brighton festival, the number of visitors during the following weekend was 256 349.
Find the difference in the number of visitors during the two weekends.

TTh	Th	H	T	O
	2	7	3	9
×			2	8
$^{2}2$	$^{5}1$	$^{3}9$	$^{7}1$	2
$^{1}5$	4	$^{1}7$	8	0
7	6	6	9	2

1

A zookeeper prepares 825 kg of food for the zoo's elephants each week.
What is the total mass of food the zookeeper prepares for the elephants over 16 weeks?
What is the total mass of food the zookeeper prepares for the elephants over 32 weeks?

	4	2	6	6
2	8	5	$^{1}3$	$^{1}2$

		0	3	6	
1	2	4	3	2	(×30)
	–	3	6	0	
			7	2	
	–		7	2	(×6)
				0	

12 × 1 = 12
12 × 2 = 24
12 × 3 = 36
12 × 4 = 48
12 × 5 = 60
12 × 6 = 72
12 × 7 = 84
12 × 8 = 96
12 × 7 = 108
12 × 10 = 120

With remainders

			2	4	r	1	2
1	5	3	7	2			
	–	3	0	0			
			7	2			
	–		6	0			
			1	2			

			2	4	$\frac{4}{5}$
1	5	3	7	2	
	–	3	0	0	
			7	2	
	–		6	0	
			1	2	

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