St. Monica's Primary School

Calculation Policy: Stages of Progression

Based on the White Rose Calculation Policy and adapted as necessary to meet the needs of our school.

Introduction:

Our aim is for the children to be confident, accurate and efficient as they complete calculations. This will provide a solid basis for essential life-skills and enable them to access problem solving and reasoning questions. They will use their calculation skills to help them justify and explain and prove their thinking.

The following calculation policy shows the expected stages of progression for each of the four operations. The children should work through these stages, spending as much time as necessary to master each strategy. Children should not be moved on until their understanding is secure. Children should understand the importance of choosing the most efficient strategy and also using a different strategy as a way of checking their answers, alongside completing the inverse calculation.

Calculations should be practised regularly during maths lessons as “4 a day” to consolidate understanding and build fluency, accuracy and efficiency.

The calculation policy links in with the White Rose scheme of learning but has been adapted to meet the needs of our children. Staff should be aware of the adaptations made throughout the scheme. Images and strategies modelled by White Rose have been included, as children should use these to support their understanding. The will also promote mental strategies the children will use when calculating alongside the formal written methods.

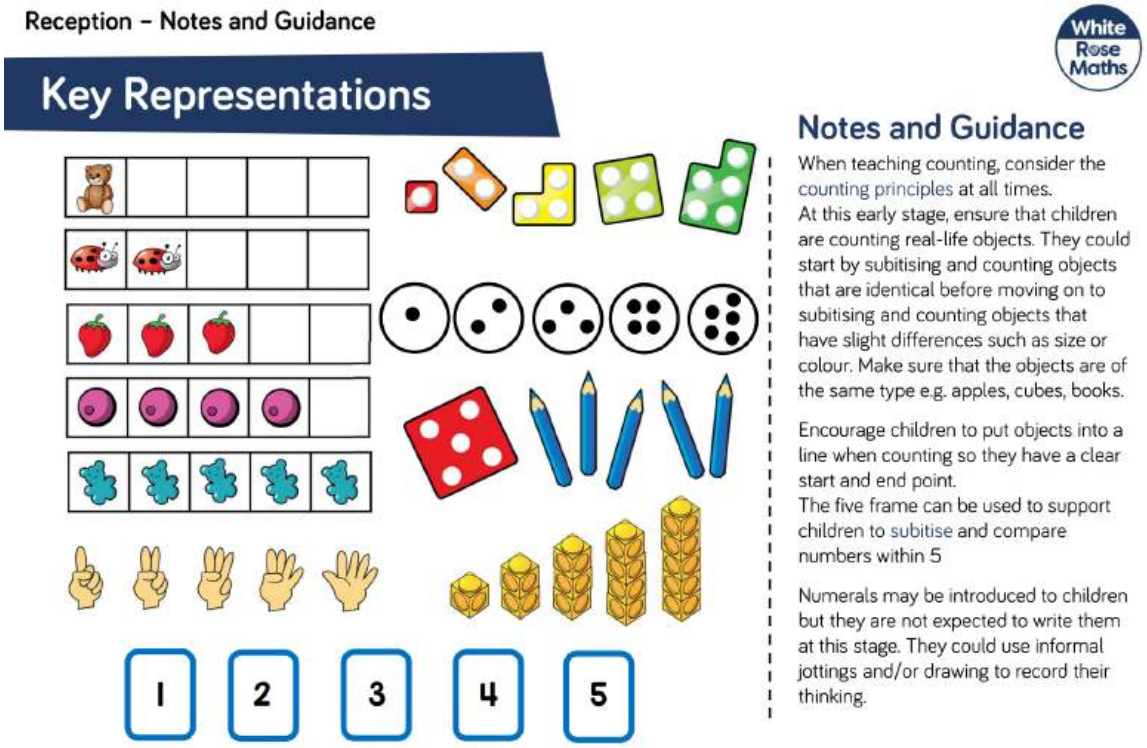
The policy follows our concrete → pictorial → abstract approach to maths teaching and it is vital children use each aspect to support their understanding.

EYFS

As with the rest of the school, EYFS will follow the White Rose scheme of leaning, which links in with the Early Learning Goals for 2021.

Maths will be practical, with real life contexts given. The children will record informally.

Vocab?



Number ELG

Children at the expected level of development will:

- Have a deep understanding of number to 10, including the composition of each number;
- Subitise (recognise quantities without counting) up to 5
- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.

Numerical Patterns

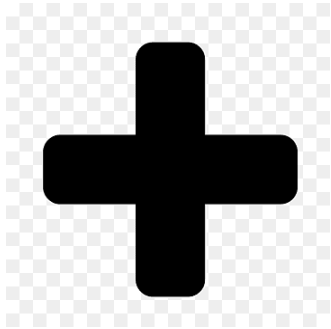
ELG Children at the expected level of development will:

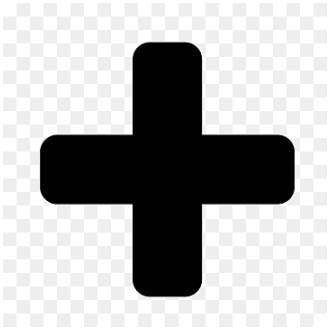
- Verbally count beyond 20, recognising the pattern of the counting system;
- Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity; -
- Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.

This will be added to and updated in response to EFYS training from September 2021.

Calculation Policy: Stages of Progression

Addition



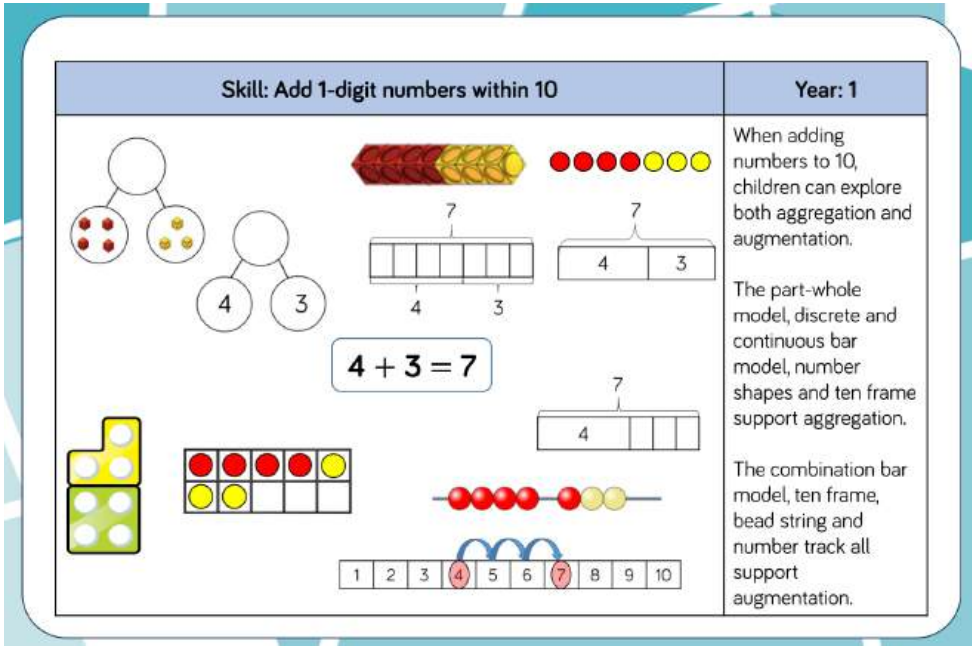


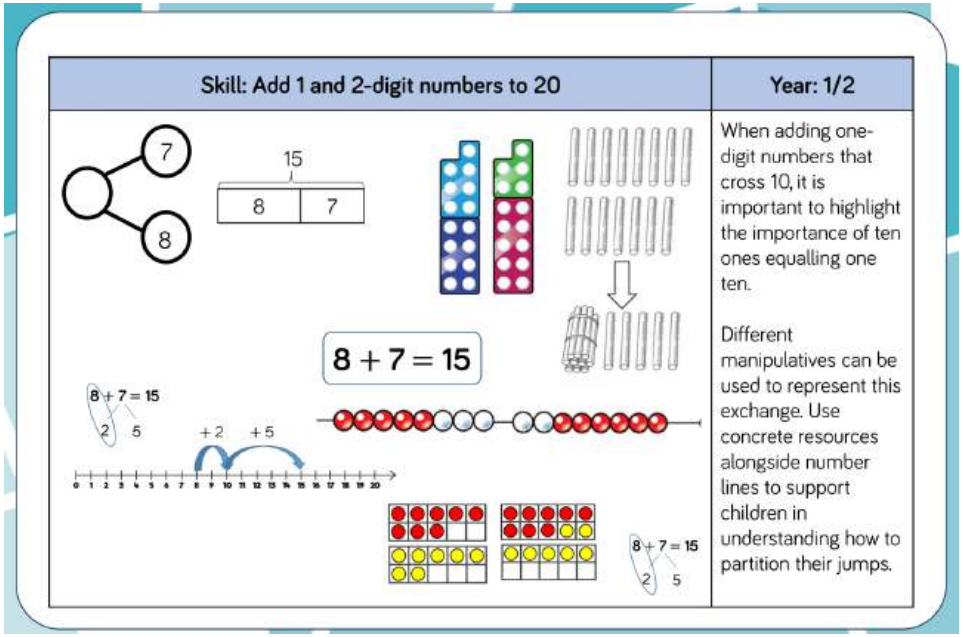
Year 1:

End of Year Objective:

Add one-digit and two-digit numbers to 20, including zero (using concrete objects and pictorial representations).

Children will continue to use practical equipment, combining groups of objects to find the total by counting all or counting on. Using their developing understanding of place value, they will move on to be able to use Base 10/ Bar/ Numicon equipment to make teens numbers using separate tens and units.

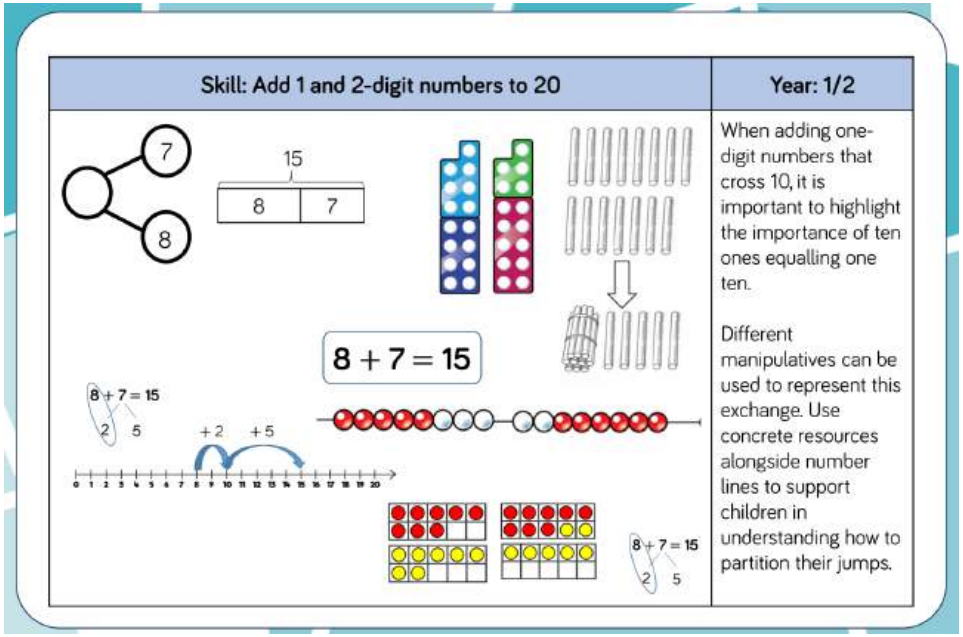


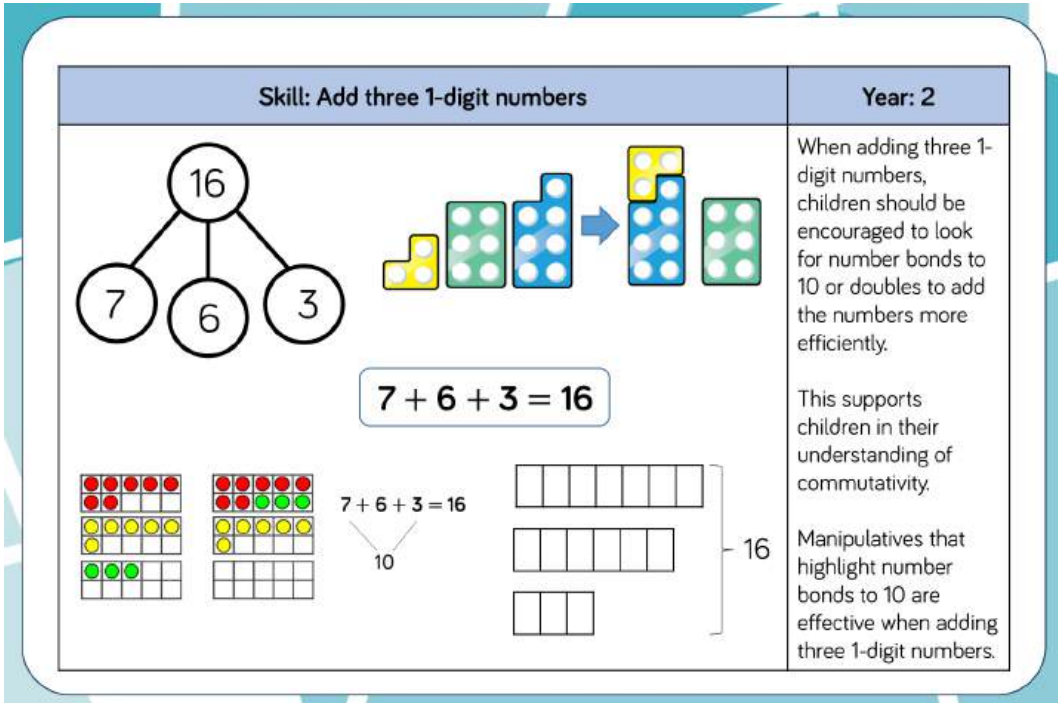


Year 2:

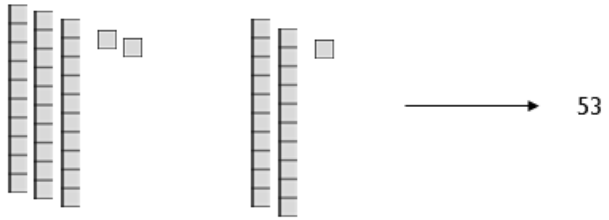
End of Year Objective:

Add numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; three one-digit numbers.





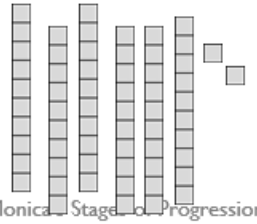
Children will continue to use the Base 10/ Bar equipment to support their calculations. For example, to calculate 32 + 21, they can make the individual amounts, counting the tens first and then count on the units.



When the units total more than 10, children should be encouraged to exchange 10 units/ones for 1 ten. This is the start of children understanding 'carrying' in vertical addition. For example, when calculating 35 + 27, they can represent the amounts using Base 10 as shown:

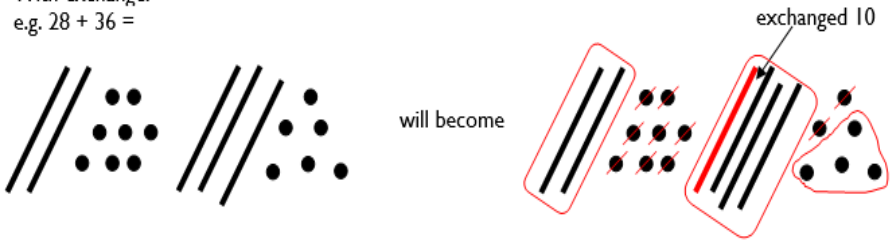
Then, identifying the fact that there are enough units/ones to exchange for a ten, they can carry out this exchange:

To leave:



Children can also record the calculations using their own drawings of the Base 10 equipment (as slanted lines for the 10 rods and dots for the unit blocks).
e.g. 34 + 23 =

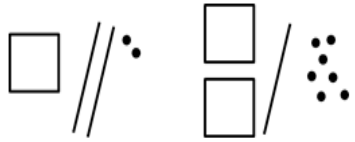
With exchange:
e.g. 28 + 36 =



so 28 + 36 = 64 should be recorded as

20+30 = 50
8 + 6 = 14
50 + 14 = 64

It is important that children circle the remaining tens and units/ones after exchange to identify the amount remaining.
This method can also be used with adding three digit numbers, e.g. 122 + 217 using a square as the representation of 100.



Children should not be moved on to formal recording without the use of concrete or pictorial representations until they are fully confident.

		T	O	
		3	6	
	+	4	3	
			9	
		7	0	
		7	9	

Alongside concrete and pictorial representation children will be shown a written method to record their addition.

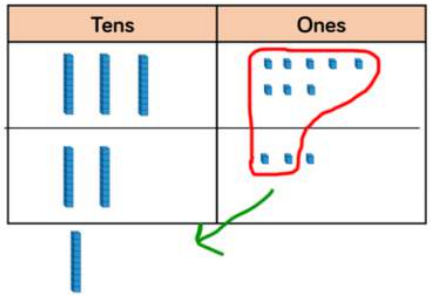
Children will vertically record their calculation: adding the ones then tens, before combining to find the total.

This method will enhance the children's understanding of exchange between ones and tens.

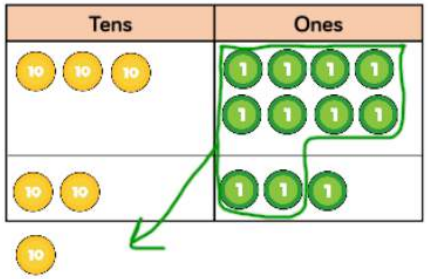
Once the children are secure using this method , they will be moved on to formal recording.

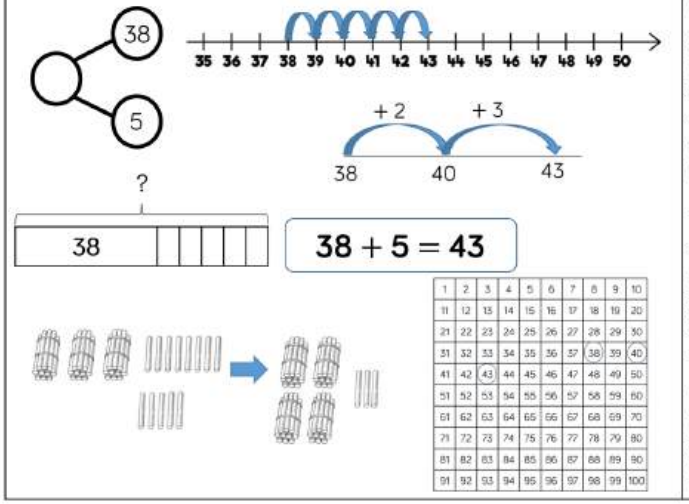
		T	O	
		3	6	
	+	4	3	
		7	9	
		1		

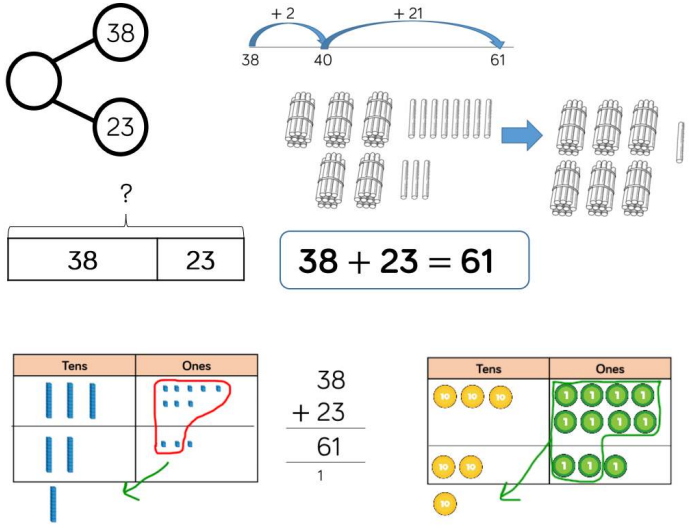
These images will support the children's understanding of adding two 2-digit numbers with exchange.



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



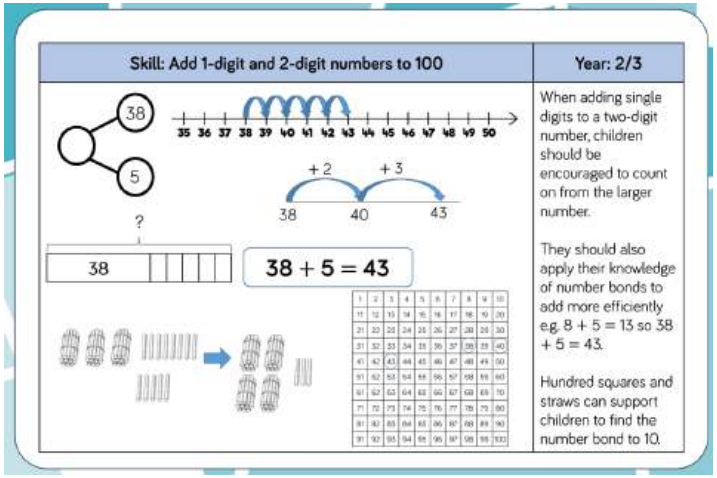
Skill: Add 1-digit and 2-digit numbers to 100	Year: 2/3
	When adding single digits to a two-digit number, children should be encouraged to count on from the larger number. They should also apply their knowledge of number bonds to add more efficiently e.g. 8 + 5 = 13 so 38 + 5 = 43. Hundred squares and straws can support children to find the number bond to 10.

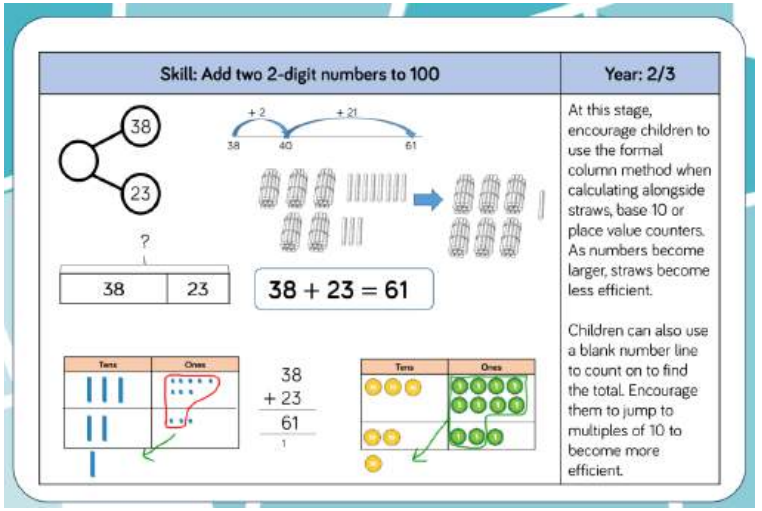
Skill: Add two 2-digit numbers to 100	Year: 2/3
	At this stage, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient. Children can also use a blank number line to count on to find the total. Encourage them to jump to multiples of 10 to become more efficient.

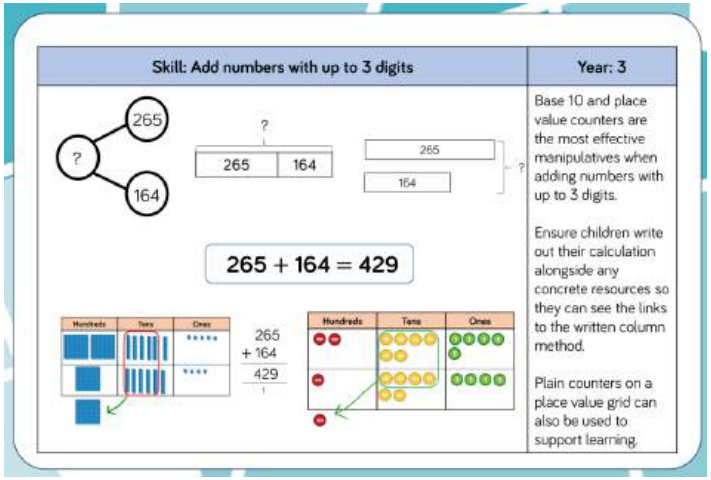
Year 3:

End of Year Objective:

Add numbers with up to three digits, using formal written method of column addition.

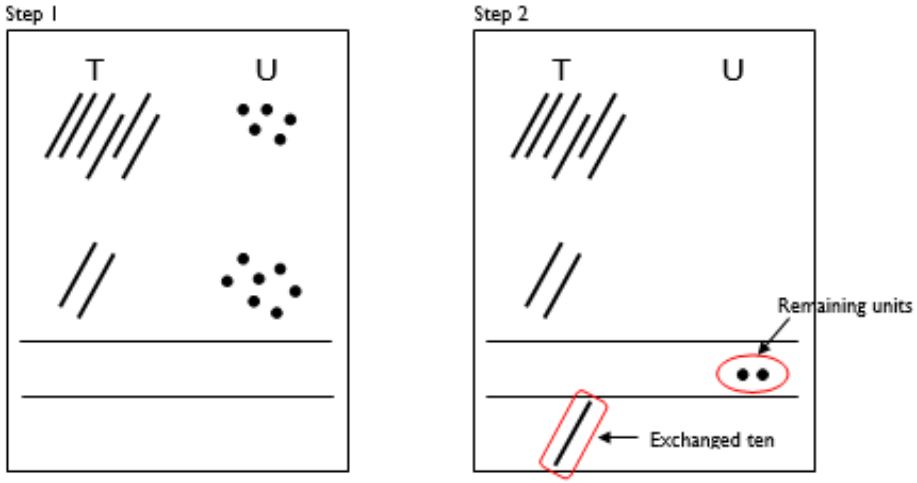






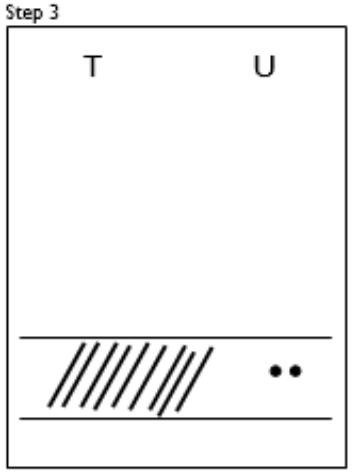
Children will use a place value grid to set the calculation out vertically and to support their knowledge of exchange between columns (as in Step 1 in the diagram below).

e.g. 65 + 27



Children would exchange ten units/ones for a ten, placing the exchanged ten below the equals sign. Any remaining units/ones that cannot be exchanged for a ten move into the equals sign as they are the units part of the answer (as in the diagram in Step 2 above).

If there are any tens that can be exchanged for a hundred, this can be done next. If not, the tens move into the equals sign as they are the tens part of the answer (as in the diagram in Step 3 below).



Written method

Step 1

	T	U
	6	5
+	2	7

Step 2

	T	U
	6	5
+	2	7
		2
	1	

Step 3

	T	U
	6	5
+	2	7
	9	2
	1	

Children should utilise this practical method to link their understanding of exchange to how the column method is set out. Teachers should model the written method alongside this practical method initially.

This should progress to children utilising the written and practical methods alongside each other and finally, and when they are ready, to children utilising just the written method.

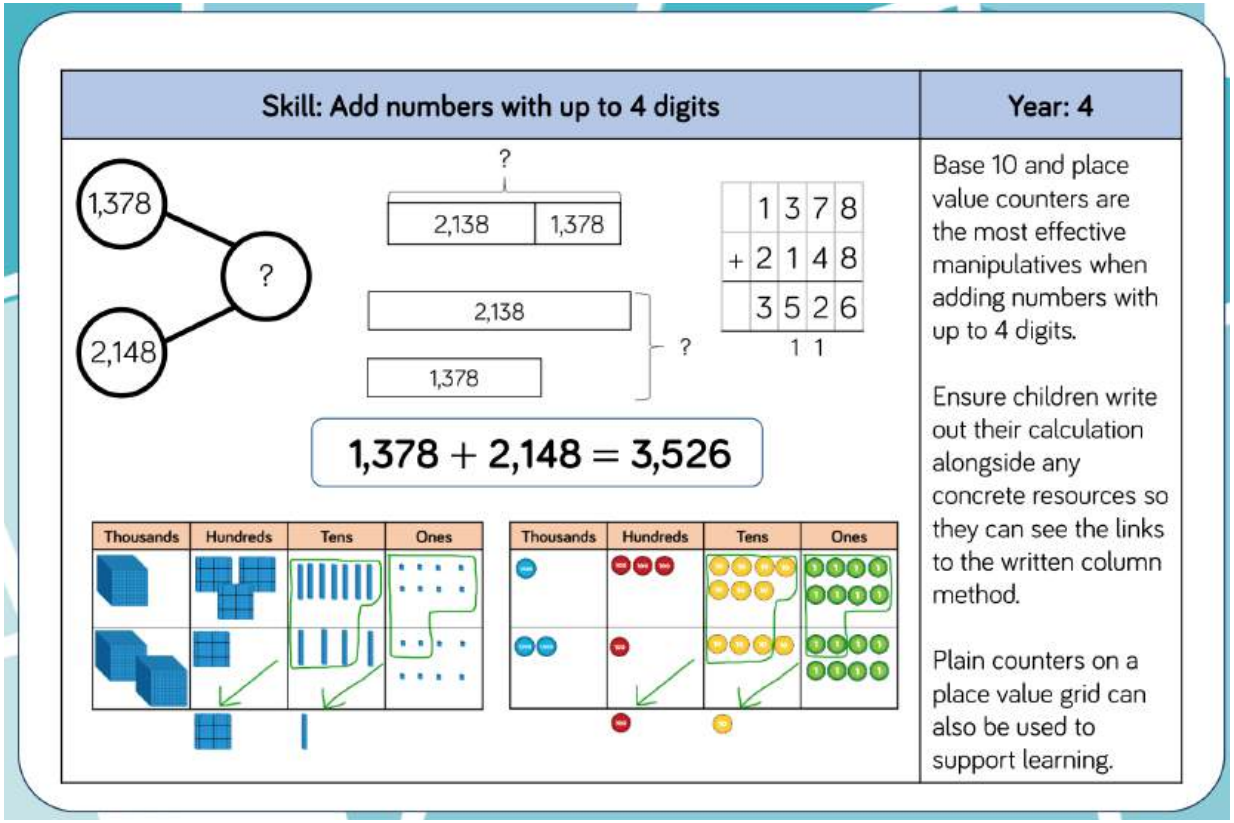
By the end of year 3, children should also extend this method for three digit numbers.

Before moving on to the formal written method, the children should be secure in using the expanded addition method.

Year 4:

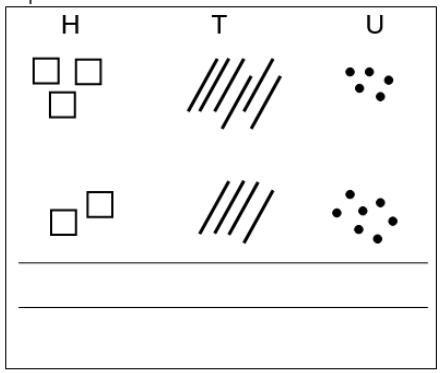
End of Year Objective:

Add numbers with up to 4 digits *and decimals with one decimal place* using the formal written method of columnar addition where appropriate.



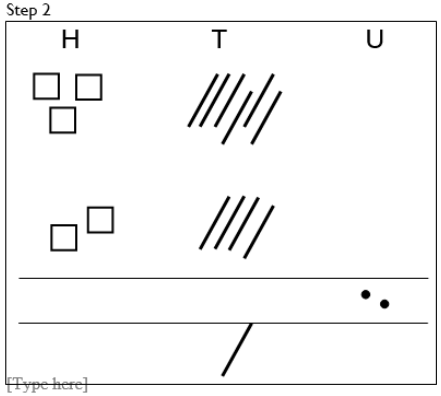
Children will move to year 4 using whichever method they were using as they transitioned from year 3.

Step 1



	H	T	U
	3	6	5
+	2	4	7

Step 2



	H	T	U
	3	6	5
+	2	4	7
			2
		1	

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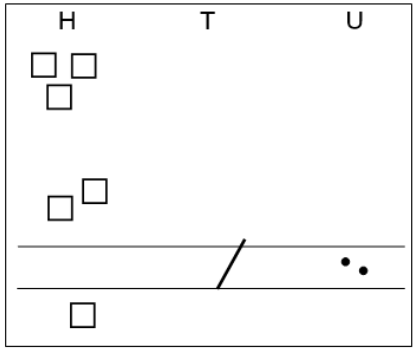
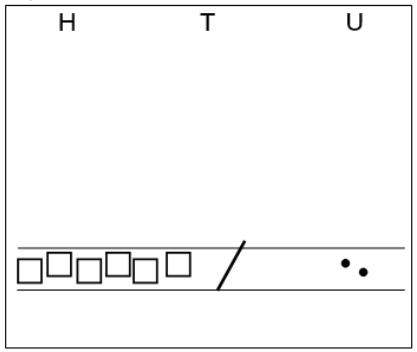
Step 3



	H	T	U
	3	6	5
+	2	4	7
		1	2
	1	1	

Step 4



	H	T	U
	3	6	5
+	2	4	7
	6	1	2
	1	1	

By the end of year 4, children should be using the written method confidently and with understanding. They will also be adding:

- several numbers with different numbers of digits, understanding the place value;
- *decimals with one decimal place, knowing that the decimal points line up under one another.*

It is so important that we are not moving the children on too quickly. If they are not able to record formal addition using the abstract method only, they are not ready to add with tenths. Decimals must only be introduced when confidence in 4 digit addition is secure.

Year 5:

Y5

End of Year Objective:
Add whole numbers with more than 4 digits *and decimals with three decimal places*, including formal written methods (columnar addition).

Children should continue to use the carrying method to solve calculations such as:

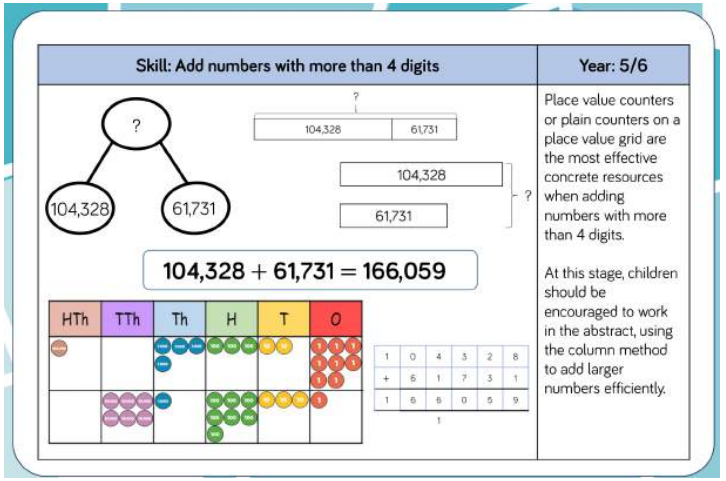
```
  3 3 6 4
+   2 4 7
-------
  3 6 1 1
-------
    1 1
```

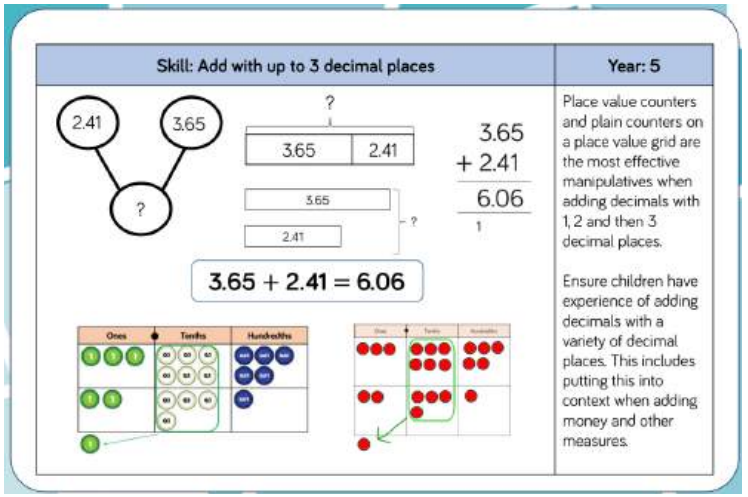
```
  3 1 2 1
      3 7
+   1 4 8
-------
  3 3 0 6
-------
    1 1
```

```
  3 . 5 6
+ 2 . 4 7
-------
  6 . 0 3
-------
      1
```

They will also be adding:

- several numbers with different numbers of digits, understanding the place value;
- *decimals with up to two decimal places (with each number having the same number of decimal places), knowing that the decimal points line up under one another.*
- amounts of money and measures, including those where they have to initially convert from one unit to another





Year 6:

Y6

End of Year Objective:
Add whole numbers and decimals using formal written methods (columnar addition).

Children should extend the carrying method and use it to add whole numbers and decimals with any number of digits.

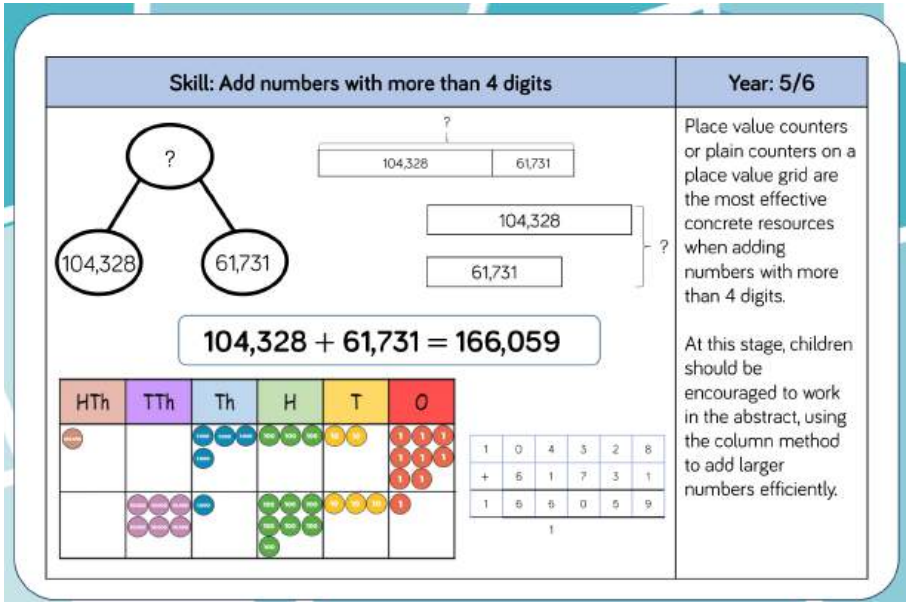
```
    4 2
  6 4 3 2
    7 8 6
        3
+   4 6 8 1
  1 1 9 4 4
  1 1 2 1
```

```
    4 0 1 . 2 0
      2 6 . 8 5
+       0 . 7 1
    4 2 8 . 7 6
        1
```

When adding decimals with different numbers of decimal places, children should be taught and encouraged to make them the same through identification that 2 tenths is the same as 20 hundredths, therefore, 0.2 is the same value as 0.20.

They will also be adding:

- several numbers with different numbers of digits, understanding the place value;
- *decimals with up to two decimal places (with mixed numbers of decimal places), knowing that the decimal points line up under one another.*
- amounts of money and measures, including those where they have to initially convert from one unit to another.



Addition: Important reminders…

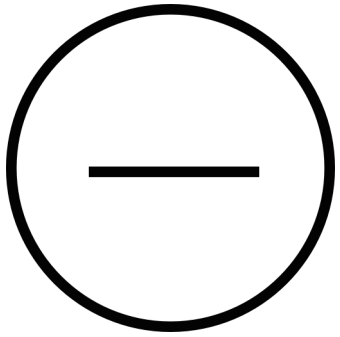
Exchanging is to be done at the bottom of the equals sign.

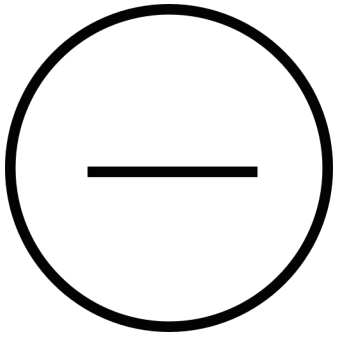
Children have got to be secure with their number bonds to 20 – use of concrete materials is vital to consolidate this understanding.

Our aim is that by the end of Y6 children use mental methods (with jottings) when appropriate, but for calculations they can not do in their heads, they use an efficient formal written method accurately.

Calculation Policy: Stages of Progression

Subtraction





Year 1:

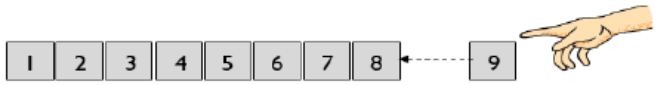
End of Year Objective:

Subtract one-digit and two-*digit numbers* to 20, including zero (using concrete objects and pictorial representations).

Children will continue to use practical equipment and taking away strategies. Initially, to avoid the need to exchange for subtraction at this stage, it is advisable to continue to use equipment such as counters, cubes and the units from the Base 10 equipment, but not the tens, e.g. 13 - 4 . Following up from this, the children will need to recognise the importance of ten ones equal one ten, and use this knowledge to cross the tens boundary. For example, to calculate 13—5 =, firstly subtract 3, then subtract the remaining 2.

Touch count and remove the number to be taken away, in this case 4.

Touch count to find the number that remains.



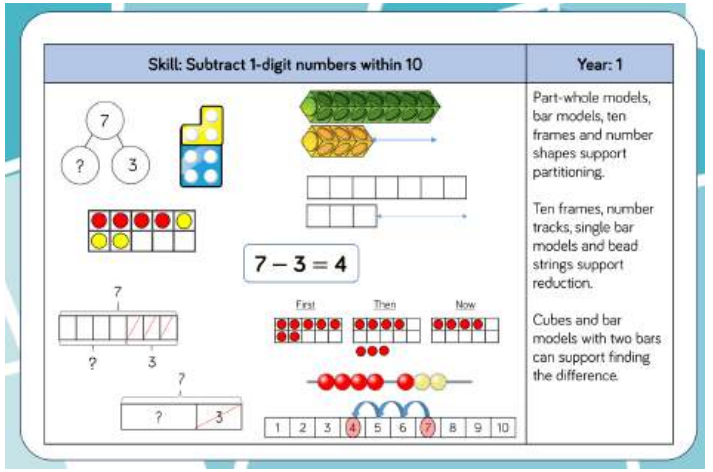
Number lines can be used.
9-5 =4
Put your finger on the number line. Count back five.

Counting on to find a small difference.
Introduce complementary addition to find differences (only use for small differences)
The use of models and concrete materials are very important to understand the idea of difference.

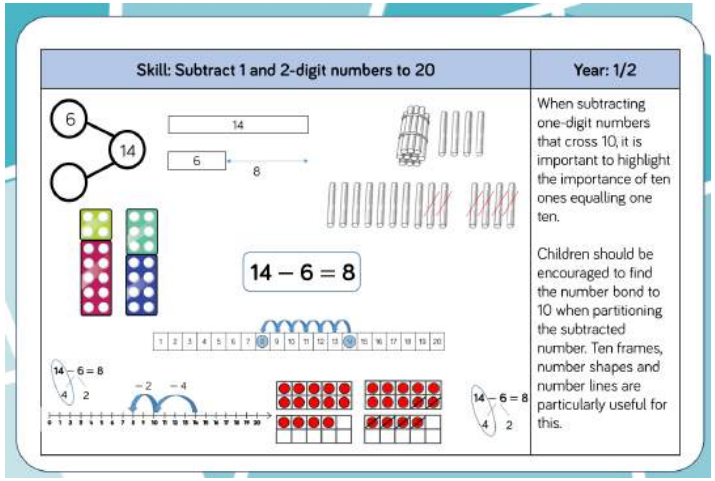
Count up from the smallest number to the largest to find the difference using resources such as beads, counters etc

11-9 = 2

The difference between nine and eleven is 2



As the children become secure with subtracting within 20, they can progress and move on using bigger numbers.

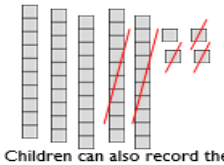


Year 2:

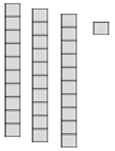
End of Year Objective:

Subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers.

Children will continue working with Base 10 equipment to support their calculations, still using a take away or removal method. They need to understand that the number being subtracted does not appear as an amount on its own, but rather as part of the larger amount. For example, to calculate 54 - 23, children would count out 54 using the Base 10 equipment (5 tens and 4 units). They need to consider whether there are enough units/ones to remove 3, in this case there are, so they would remove 3 units and then two tens, counting up the answer of 3 tens and 1 unit to give 31.



which leaves

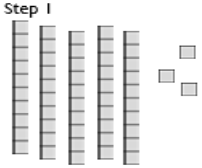


so 54 – 23 = 31

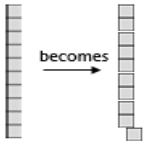
Children can also record the calculations using their own drawings of the Base 10 equipment (as slanted lines for the 10 rods and dots for the unit blocks), e.g. to calculate 39 – 17 children would draw 39 as 3 tens (lines) and 4 units (dots) and would cross out 7 units and then one ten, counting up the answer of 2 tens and 2 units to give 22.

Circling the tens and units that remain will help children to identify how many remain.
When the amount of units to be subtracted is greater than the units in the original number, an exchange method is required. This relies on children's understanding of ten units being an equivalent amount to one ten. To calculate 53 – 26, by using practical equipment, they would count out 53 using the tens and units, as in Step 1. They need to consider whether there are enough units/ones to remove 6. In this case there are not so they need to exchange a ten into ten ones to make sure that there are enough, as in step 2.

Step 1

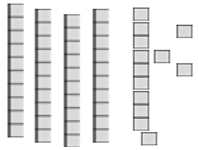


Step 2

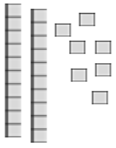


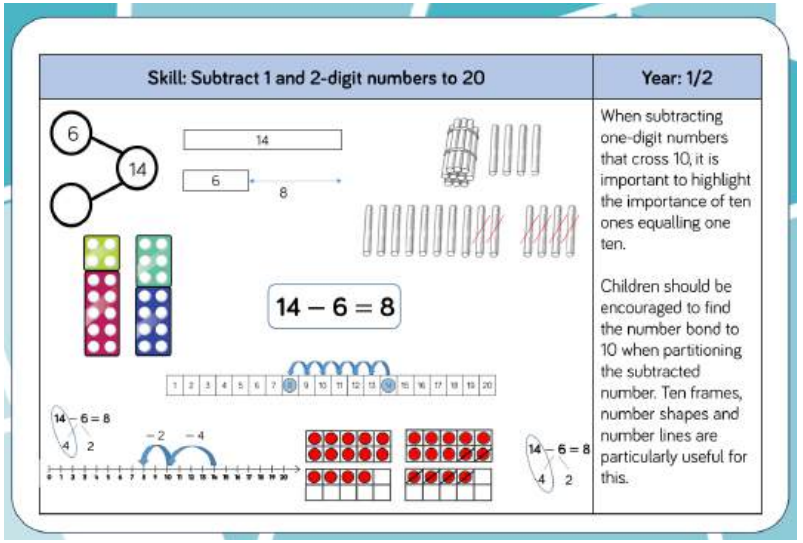
The children can now see the 53 represented as 40 and 13, still the same total, but partitioned in a different way, as in step 3 and can go on to take away the 26 from the calculation to leave 27 remaining, as in Step 4.

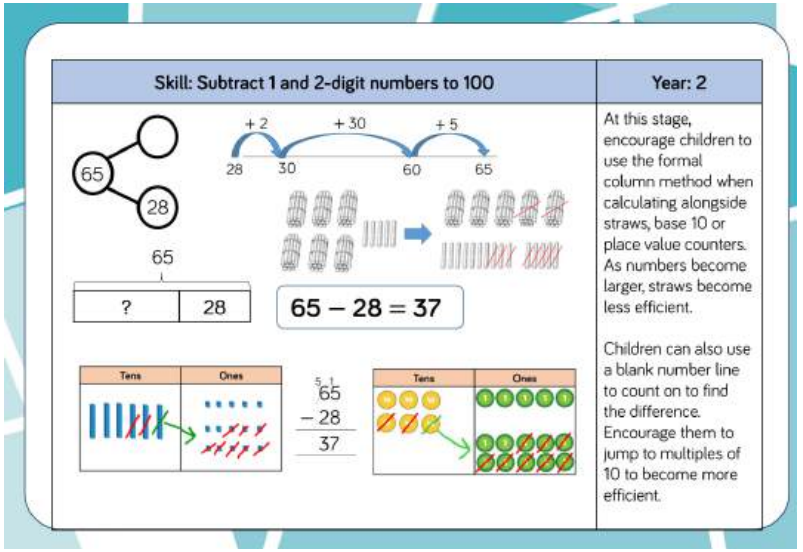
Step 3



Step 4



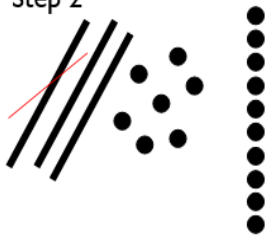




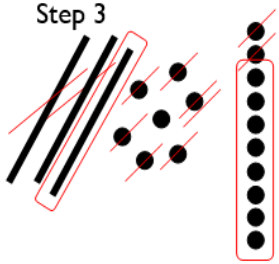
When recording their own drawings, when calculating 37 – 19, children would cross out a ten and exchange for ten units. Drawing them in a vertical line, as in Step 2, ensures that children create ten ones and do not get them confused with the units that were already in place.

Step 1

Step 2



Step 3



Circling the tens and units that remain will help children to identify how many remain.

Empty or numbered lines are a useful way of subtracting. The steps can be recorded as counting on or back.

	T	O			7	0		
	8	6			8	0	+	1 6
-	2	7		-	2	0	+	7
	5	9			7	0	+	9

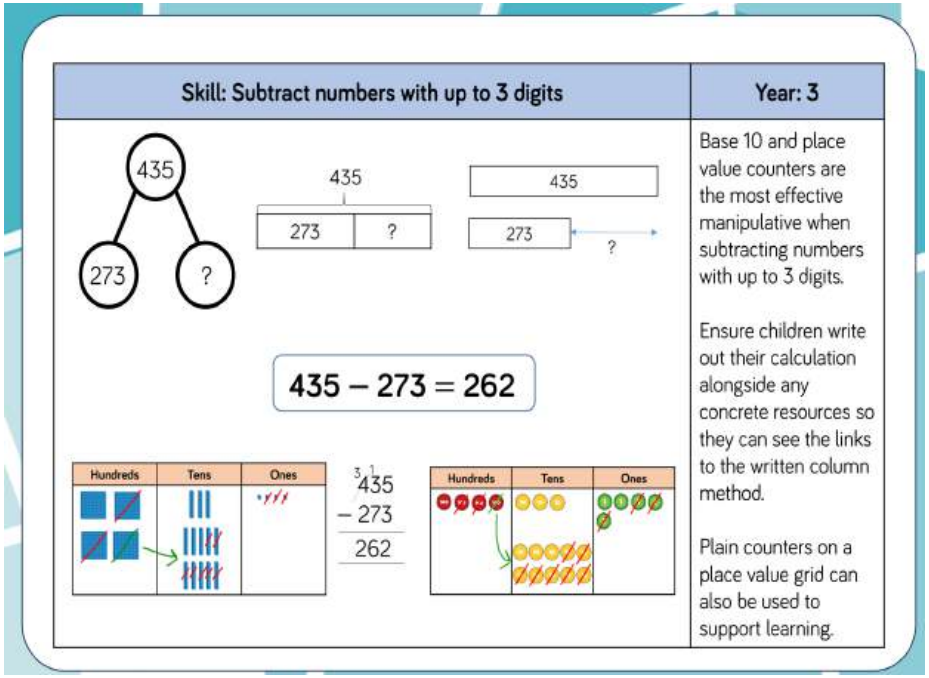
To move on from pictorial representation to abstract, children should be shown the expanded column method for subtraction.

Tens and ones should be partitioned and any exchanges made before the subtraction is completed.

Year 3:

End of Year Objective:

Subtract numbers with up to three digits, using formal written method of column subtraction.



Children will build on their knowledge of using Base 10 equipment from Y2 and continue to use the idea of exchange. This process should be demonstrated by using Base 10 materials and jottings to represent the first number, removing the units and tens as appropriate (as with the more informal method in Y2).

```
  80 + 9
- 50 + 7
  30 + 2  = 32
```

From this the children will begin to solve problems which involve exchange.

71 – 46 =

Children need to consider whether there are enough units/ones to remove 6. In this case there are not so they need to exchange a ten into ten ones to make sure that there are enough, as they have been doing in the method for Year 2 (Step 2). They should be able to see that the number is just partitioned in a different way, but the amount remains the same (71 = 70 + 1 = 60 + 11).

This will be recorded by the children as:

```
   60
   70 →  11
- 40 →   6
   20 →   5  = 25
```

By the end of year 3, children should also extend this method for three digit numbers.

Year 4:

End of Year Objective:

Subtract numbers with up to 4 digits *and decimals with one decimal place* using the formal written method of columnar subtraction where appropriate.

Children will move to Y4 using whichever method they were using as they transitioned from Y3.

Step 1

	700	50	4
-	200	80	6

Step 2 (exchanging from tens to units)

	700	~~50~~ 40	14
-	200	80	6

Step 3 (exchanging from hundreds to tens)

	~~700~~ 600	~~50~~ 140	14
-	200	80	6

Step 4

	~~700~~ 600	~~50~~ 140	14	
-	200	80	6	
	400	60	8	= 468

This would be recorded by the children as:

	~~700~~ 600	~~50~~ 140	14	
-	200	80	6	
	400	60	8	= 468

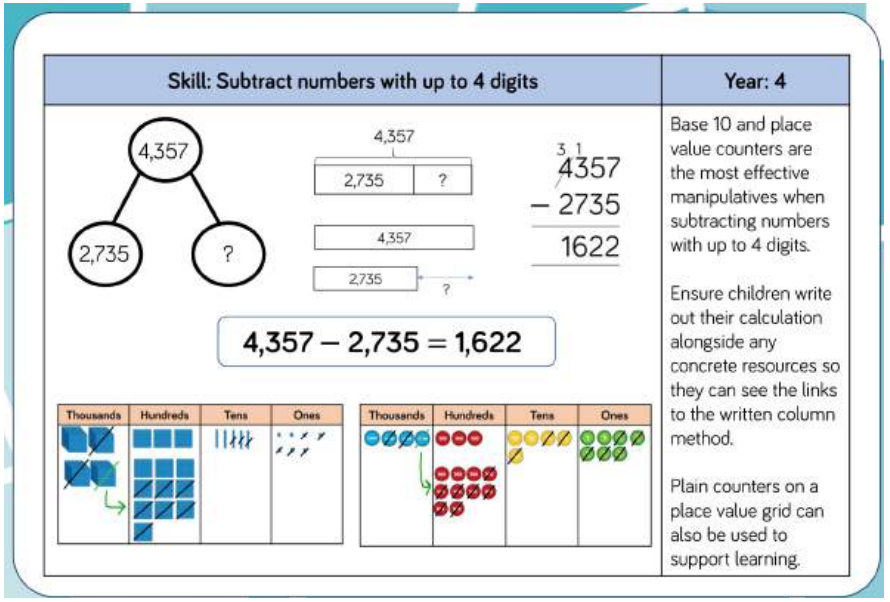
When children are ready, this leads on to the compact method of decomposition:

		~~7~~ 6	~~5~~ 14	14
	-	2	8	6
		4	6	8

Teachers need to use 14 tens subtract 8 tens not 14 subtract 8 when working in the tens column.

By the end of Y4, children should be using the written method confidently and with understanding. They will also be subtracting:

- numbers with different numbers of digits, understanding the place value;
- decimals with one decimal place, knowing that the decimal points line up under one another.



Year 5:

End of Year Objective:

Subtract whole numbers with more than 4 digits *and decimals with two decimal places*, including formal written methods (columnar subtraction).

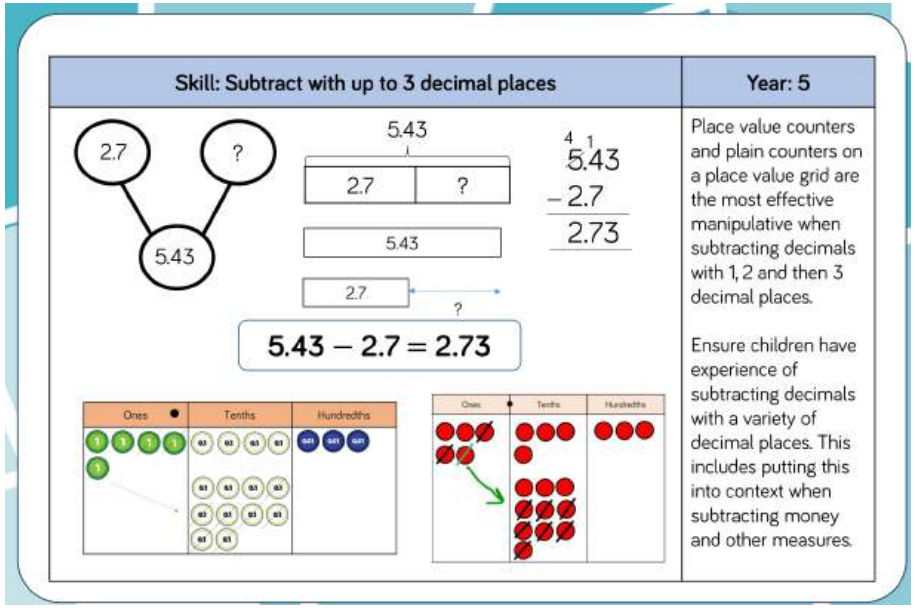
Children should continue to use the decomposition method to solve calculations such as:

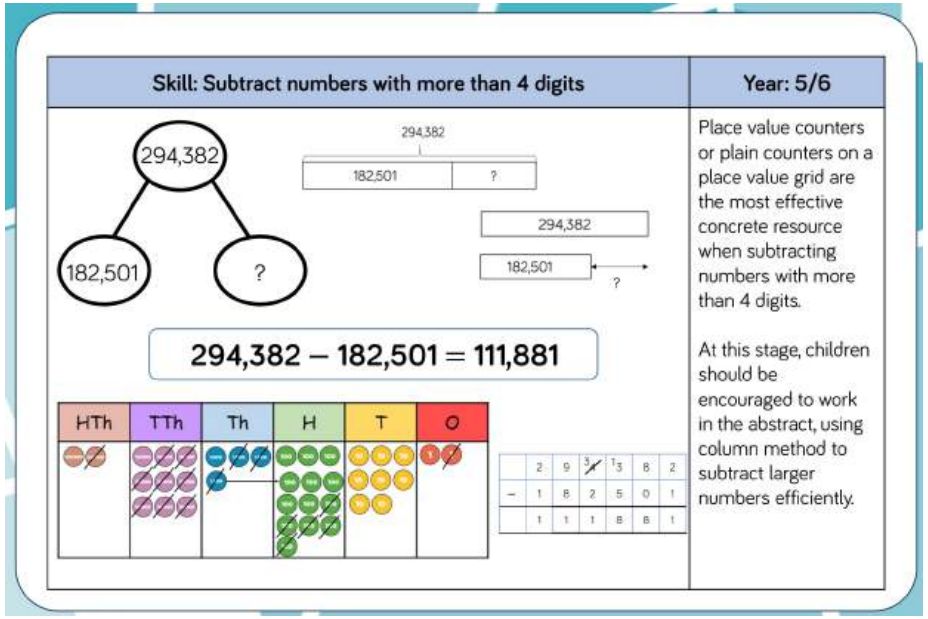
$$\begin{array}{r} {}^{6}\cancel{7}\,{}^{1}0\,{}^{6}\cancel{7}\,{}^{1}2 \\ -\ 3\ 2\ 2\ 6 \\ \hline 3\ 8\ 4\ 6 \end{array} \qquad \begin{array}{r} {}^{2}\cancel{3}\,.\,{}^{13}\cancel{4}\,{}^{1}2 \\ -\ 1\ .\ 7\ 6 \\ \hline 1\ .\ 6\ 6 \end{array}$$

Ensure the decimal points line up

They will also be subtracting:

- numbers with different numbers of digits, understanding the place value;
- decimals with up to two decimal places (with each number having the same number of decimal places), knowing that the decimal points line up under one another.
- amounts of money and measures, including those where they have to initially convert from one unit to another





Year 6:

End of Year Objective:

Subtract whole numbers and decimals using formal written methods (columnar subtraction)

Children should extend the decomposition method and use it to subtract whole numbers and decimals with any number of digits.

$$\begin{array}{r} {}^{5}\cancel{6}\,{}^{13}\cancel{4}\,{}^{1}3\;2 \\ -\;\;4\;6\;8\;1 \\ \hline 1\;7\;5\;1 \end{array}$$

$$\begin{array}{r} {}^{3}\cancel{4}\,{}^{1}1\,{}^{6}\cancel{7}\,.\,{}^{11}\cancel{2}\,{}^{1}0 \\ -\;\;\;3\;4\;.\;7\;1 \\ \hline 3\;8\;2\;.\;4\;9 \end{array}$$

When subtracting decimals with different numbers of decimal places, children should be taught and encouraged to make them the same through identification that 2 tenths is the same as 20 hundredths, therefore, 0.2 is the same value as 0.20.

They will also be subtracting:

- numbers with different numbers of digits, understanding the place value;
- decimals with up to two decimal places (with mixed numbers of decimal places), knowing that the decimal points line up under one another.
- amounts of money and measures, including those where they have to initially convert from one unit to another.

Important reminders…

Exchanging is to be done at the top of the calculation.

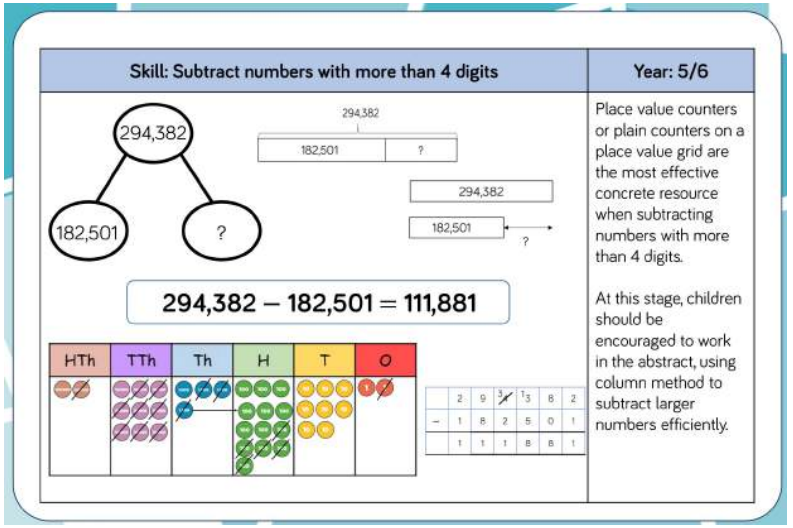
Children have got to be secure with their number bonds to 20 – use of concrete materials is vital to consolidate this understanding.

Our aim is that by the end of Y6 children use mental methods (with jottings) when appropriate, but for calculations they can not do in their heads, they use an efficient formal written method accurately.

Children need to be exposed to the wide selection of mathematical language used for subtraction.

If at any time, pupils are making errors or are showing a lack of understanding, return to the previous stage in calculation.

Please ask a member of the maths team for any clarification of this document.



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Calculation Policy: Stages of Progression

Multiplication

Year 1:

End of Year Objective:

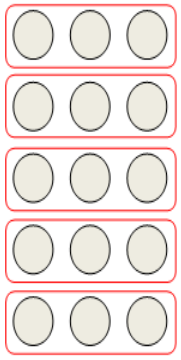
Solve one-step problems involving multiplication by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

In year one, children will continue to solve multiplication problems using practical equipment and jottings. They may use the equipment to make groups of objects. Children should see everyday versions of arrays, e.g. egg boxes, baking trays, ice cube trays, wrapping paper etc and use this in their learning, answering questions such as *'How many eggs would we need to fill the egg box*? How do you know?'

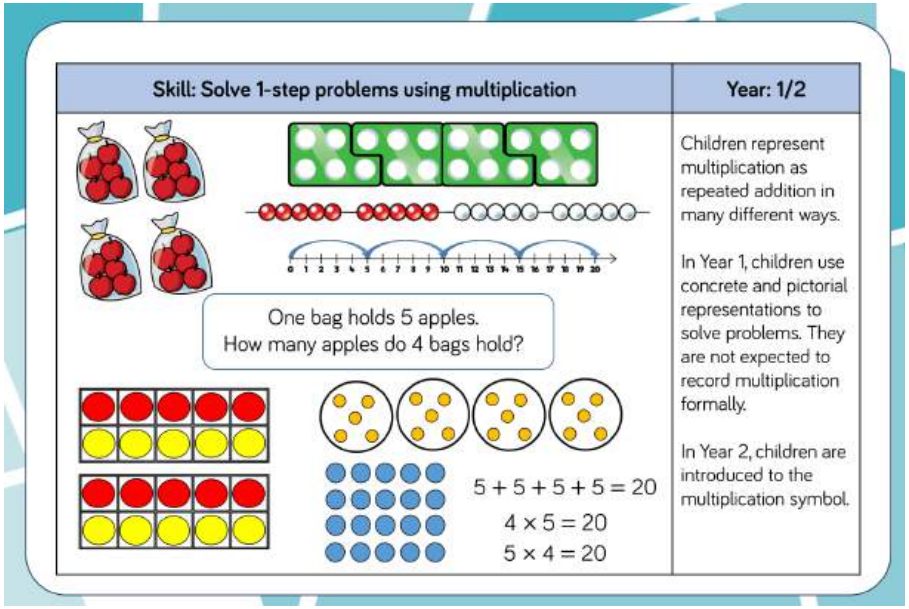
The Bar materials should be used to support this.

20				
5	5	5	5	5

Children can easily make arrays and see the connection between 5 x 3 and 3 x 5.



The multiplication sign should be read as 'lots of' from an early age. So, 5 x 3 would be read as "*5 lots of 3*" and shown pictorially as above.



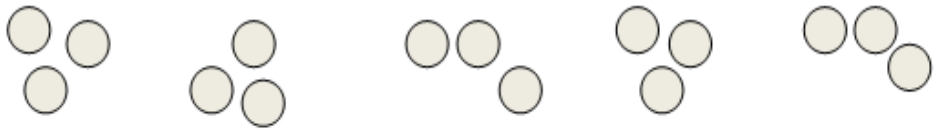
Year 2:

End of Year Objective:

Calculate mathematical statements for multiplication *(using repeated addition)* and write them using the multiplication (x) and equals (=) signs.

Children should understand and be able to calculate multiplication as repeated addition, supported by the use of practical apparatus such as counters or cubes. e.g.

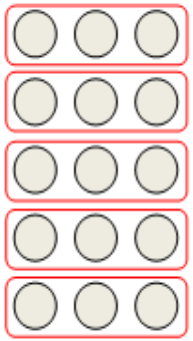
5 x 3 can be shown as five groups of three with counters, either grouped in a random pattern, as below:



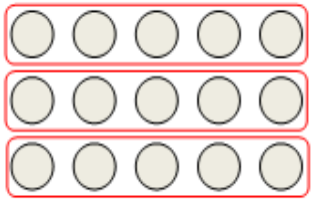
or in a more ordered pattern, with the groups of three indicated by the border outline:

Children should then develop this knowledge to show how multiplication calculations can be represented by an array, (this knowledge will support with the development of the grid method in the future). Again, children should be encouraged to use practical apparatus and jottings to support their understanding, e.g.

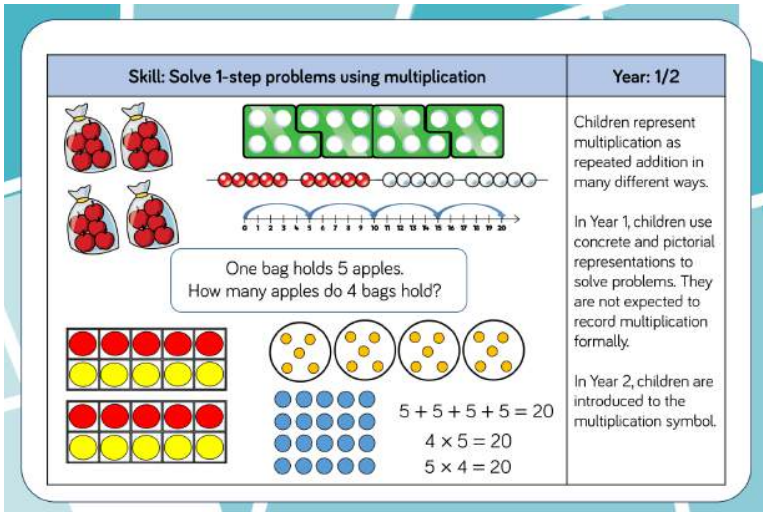
5 x 3 can be represented as an array in two forms (as it has commutativity):



3 + 3 + 3 + 3 + 3 = 15



5 + 5 + 5 = 15



Year 3:

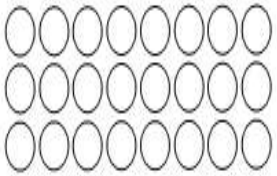
End of Year Objective:

Write and calculate mathematical statements for multiplication using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, progressing to formal written methods.

Initially, children will continue to use arrays where appropriate linked to the multiplication tables that they know (2, 3, 4, 5, 8 and 10), e.g.

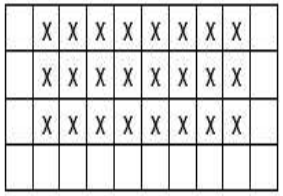
3 x 8

They may show this using practical equipment:



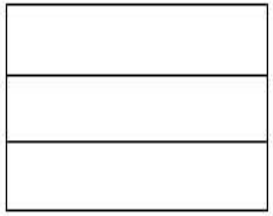
3 x 8 = 8 + 8 + 8 = 24

or by jottings using squared paper:



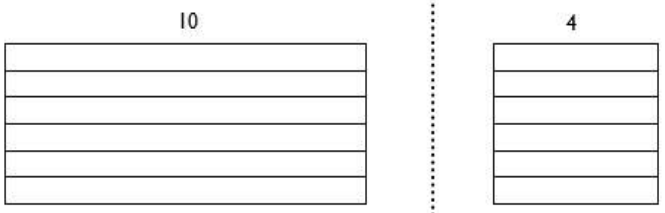
3 x 8 = 8 + 8 + 8 = 24

Or by using the bar materials and jottings:



3 x 8 = 8 + 8 + 8 = 24

As they progress to multiplying a two-digit number by a single digit number, children should use their knowledge of partitioning two digit numbers into tens and units/ones to help them. For example, when calculating 6 x 14, children should set out the array using the bar materials, then partition the array so that one array has ten columns and the other four.



Partitioning in this way, allows children to identify that the first array shows 6 x 10 and the second array shows 6 x 4. These can then be added to calculate the answer:

(6 x 10) + (6 x 4)

= 60 + 24

= 84

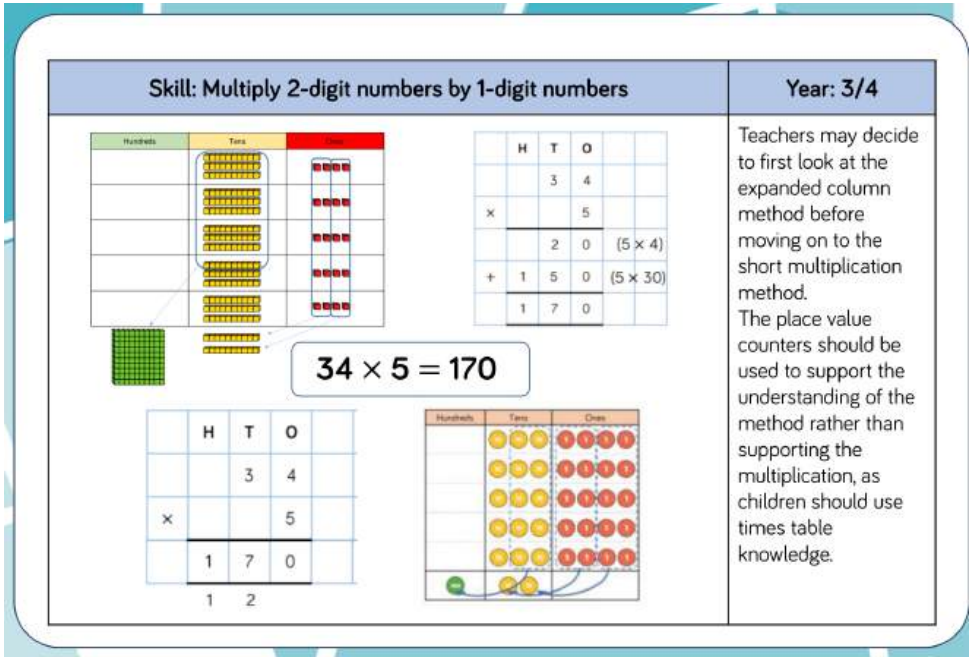
NB There is no requirement for children to record in this way, but it could be used as a jotting to support development if needed.

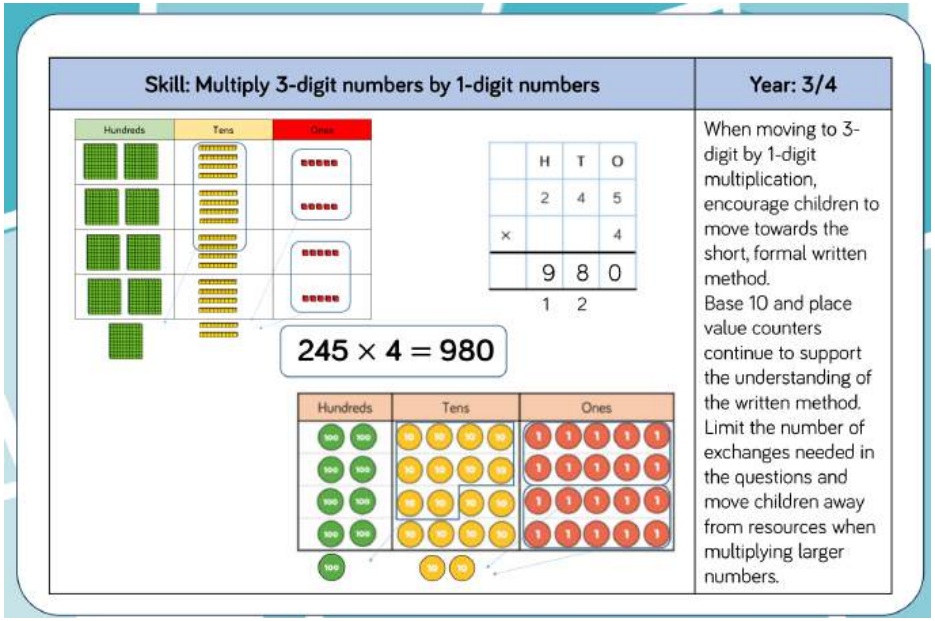
This method is the precursor step to the grid method. Using a two-digit by single digit array, they can partition as above, identifying the number of rows and the number of columns each side of the partition line.

Bars should be used to introduce the grid method using concrete materials.

For example, 10 x 13 would be shown as…

Year 3:


Skill: Multiply 2-digit numbers by 1-digit numbers
Year: 3/4
Hundreds
Tens
Ones
H T O
3 4
× 5
2 0 (5 × 4)
+ 1 5 0 (5 × 30)
1 7 0
34 × 5 = 170
H T O
3 4
× 5
1 7 0
1 2
Teachers may decide to first look at the expanded column method before moving on to the short multiplication method.
The place value counters should be used to support the understanding of the method rather than supporting the multiplication, as children should use times table knowledge.


Skill: Multiply 3-digit numbers by 1-digit numbers
Year: 3/4
Hundreds
Tens
Ones
H T O
2 4 5
× 4
9 8 0
1 2
245 × 4 = 980
Hundreds
Tens
Ones
When moving to 3-digit by 1-digit multiplication, encourage children to move towards the short, formal written method.
Base 10 and place value counters continue to support the understanding of the written method.
Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.

Units should always be calculated first in preparation for the formal method of multiplication.

It is really important that children are confident with representing multiplication statements as arrays and understand the rows and columns structure before they develop the written method of recording.

From this, children can use the grid method to calculate two-digit by one-digit multiplication calculations, initially with two-digit numbers less than 20. Children should be encouraged to set out their addition in a column at the side to ensure the place value is maintained. When children are working with numbers where they can confidently and correctly calculate the addition mentally, they may do so.

13 x 8

x	10	3
8	80	24

$$\begin{array}{r} 80 \\ +\ 24 \\ \hline 104 \end{array}$$

When children are ready, they can then progress to using this method with other two-digit numbers.

37 x 6

x	30	7
6	180	42

$$\begin{array}{r} 180 \\ +\ 42 \\ \hline 222 \end{array}$$

Children should also be using this method to solve problems and multiply numbers in the context of money or measures.

Year 4:

End of Year Objective:

Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.

Before carrying out calculations, children should be encouraged to estimate their answers using rounding. They can then compare their answer with the estimate to check for reasonableness. These estimations should also be included in 4-a-day books.

Children will move to Y4 using whichever method they were using as they transitioned from Y3. They will further develop their knowledge of the grid method to multiply any two-digit by any single-digit number, e.g.

79 x 8

x	70	9
8	560	72

$$\begin{array}{rr} & 560 \\ + & 72 \\ \hline & 632 \end{array}$$

Units should always be calculated first in preparation for the formal method of multiplication.

To support the grid method, children should develop their understanding of place value and facts that are linked to their knowledge of tables. For example, in the calculation above, children should use their knowledge that 7 x 8 = 56 to know that 70 x 8 = 560.

By the end of the year, they will extend their use of the grid method to be able to multiply three-digit numbers by a single digit number, e.g.

346 x 8

x	300	40	6
8	2400	320	48

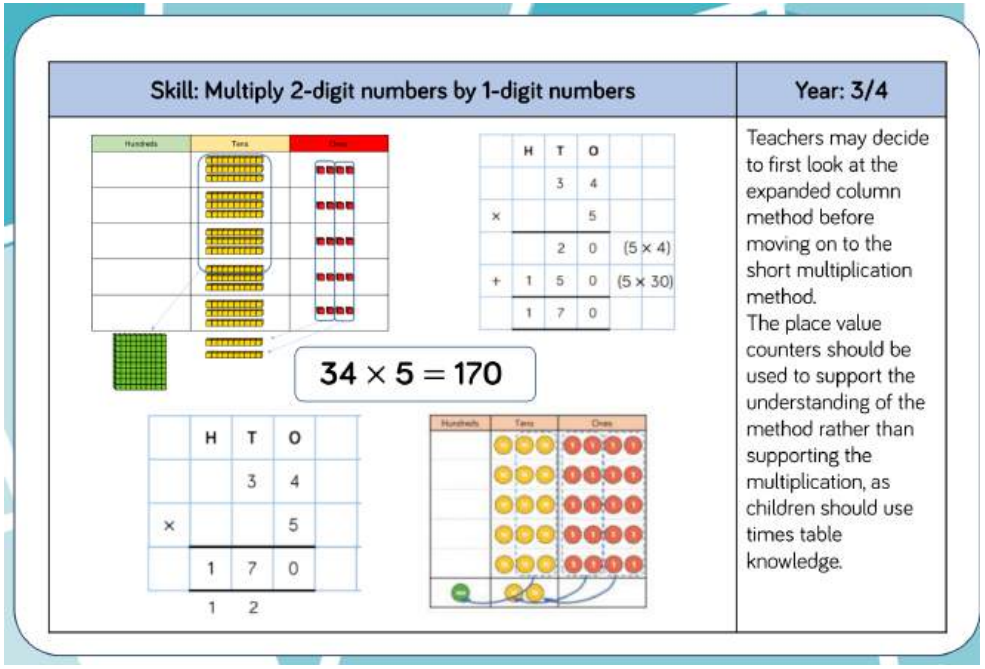
$$\begin{array}{rr} & 2400 \\ + & 320 \\ + & 48 \\ \hline & 2768 \end{array}$$

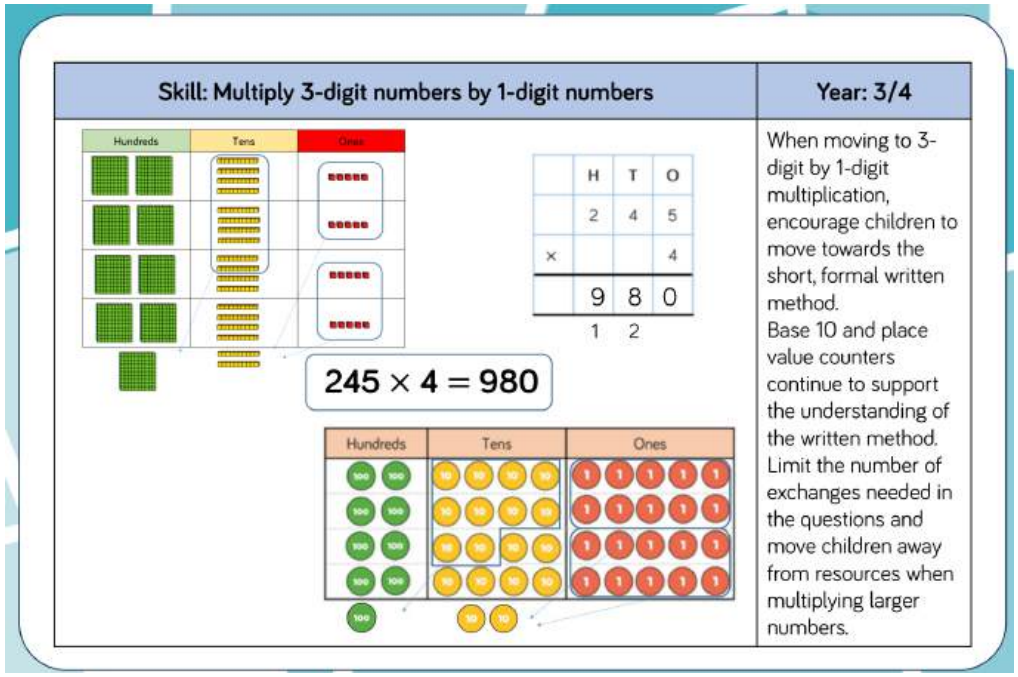
When children are working with numbers where they can confidently and correctly calculate the addition (or parts of the addition) mentally, they may do so.

Children should also be using this method to solve problems and multiply numbers in the context of money or measures.

Year 4:

When the children are secure in their understanding of the grid method, they should be moved on to the expanded written method for multiplication.





Year 5:

End of Year Objective:

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.

Children should recap on the grid method before going onto more formal methods of multiplication.

The first step is to represent the method of recording in a column format, but showing the working.

*Pupils need to **approximate** first. 38 x 7 is approximately 40 x 7 =280*

Children should multiply the units first which enables them to move towards the compact method.

(30 + 8)
x 7

56 *8 x 7*
210 *30 x 7*
266

This method requires solid understanding of the grid method, because it is the idea of partitioning and recombining but without the grid.

The recording is further reduced with the carried digits recorded below the line.

38
X 7
266
5

342 × 7 becomes

3 4 2
× 7
2 3 9 4
2 1

Answer: 2394

Long multiplication

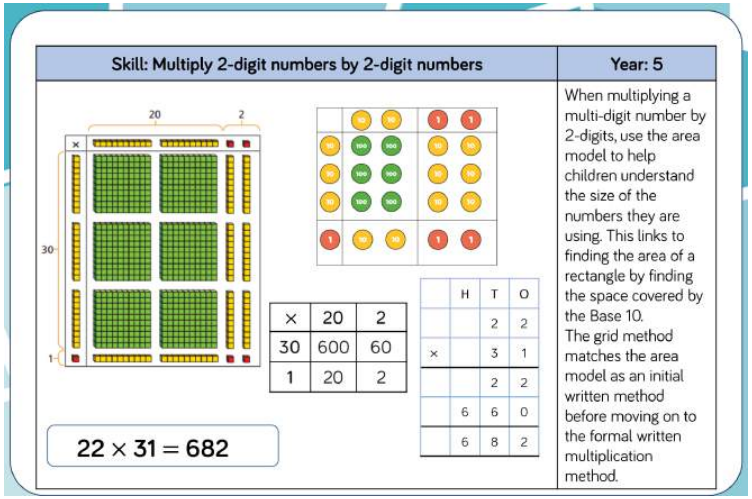
Each digit continues to be multiplied by each digit but the totals are recorded in a more compact form using carrying.

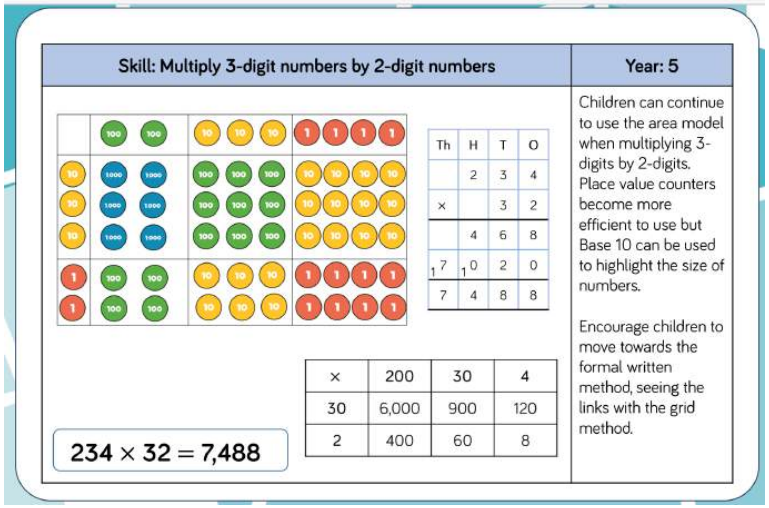
24 x 16 becomes

2
2 4
x 1 6
1 4 4
2 4 0
3 8 4

344 x 23 becomes

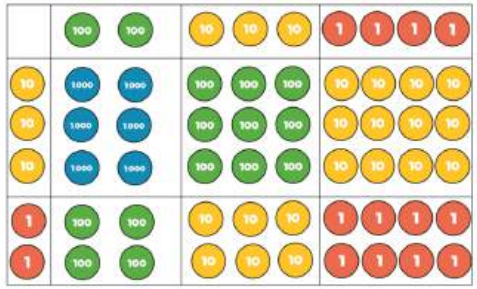
1 1
3 4 4
x 2 3
1 0 3 2
6 8 8 0
7 9 1 2
1





Skill: Multiply 3-digit numbers by 2-digit numbers

Year: 5



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

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

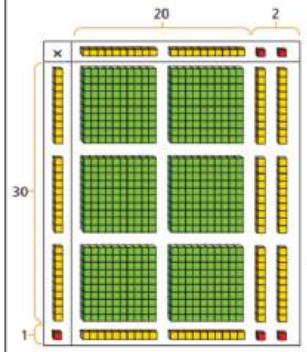
$234 \times 32 = 7{,}488$

Children can continue to use the area model when multiplying 3-digits by 2-digits. Place value counters become more efficient to use but Base 10 can be used to highlight the size of numbers.

Encourage children to move towards the formal written method, seeing the links with the grid method.

Skill: Multiply 2-digit numbers by 2-digit numbers

Year: 5



×	20	2
30	600	60
1	20	2

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

$22 \times 31 = 682$

When multiplying a multi-digit number by 2-digits, use the area model to help children understand the size of the numbers they are using. This links to finding the area of a rectangle by finding the space covered by the Base 10.
The grid method matches the area model as an initial written method before moving on to the formal written multiplication method.

Year 6:

End of Year Objective:

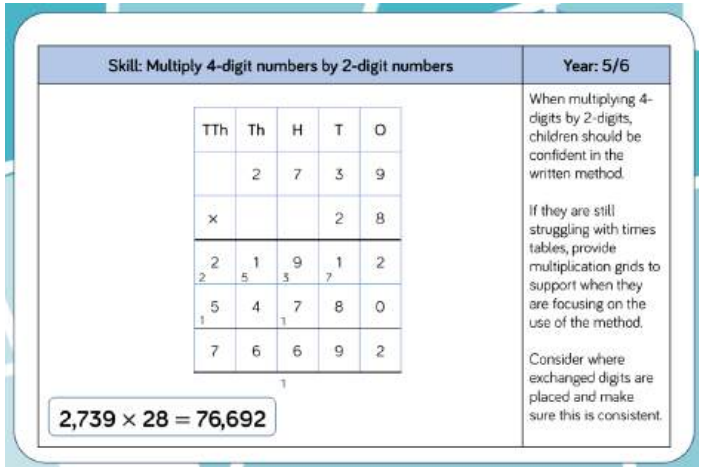
Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.

By the end of Y6, children should be able to multiply any number by a two-digit number. They should always be reminded to estimate first. Children should also develop the method to be able to multiply decimal numbers with up to two decimal places, e.g.

$$\begin{array}{r} 4.92 \\ \times \quad 3 \\ \hline 14.76 \\ \hline {\scriptstyle 2} \end{array}$$

When children are working with numbers where they can confidently and correctly calculate the addition (or parts of the addition) mentally, they may do so.

Children should also be using this method to solve problems and multiply numbers, including those with decimals, in the context of money or measures, e.g. to calculate the cost of 7 items at £8.63 each, or the total length of six pieces of ribbon of 2.28m each.



Important reminders…

Carrying is to be done at the bottom of the equals sign. The only exception to this is when children are multiplying by a two-digit number (see examples).

Children have got to be secure with their times table – use of concrete materials is vital to consolidate this understanding.

Children must understand what they are doing when they multiply by multiples of ten – encourage them to say eg "it's ten times bigger".

Our aim is that by the end of Y6 children use mental methods (with jottings) when appropriate, but for calculations they can not do in their heads, they use an efficient formal written method accurately.

Children need to be exposed to the wide selection of mathematical language used for multiplication.

If at any time, pupils are making errors or are showing a lack of understanding, return to the previous stage in calculation.

Calculation Policy: Stages of Progression

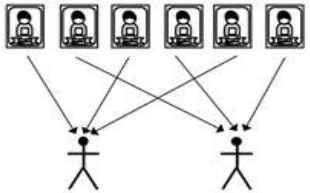
Division

Year 1:

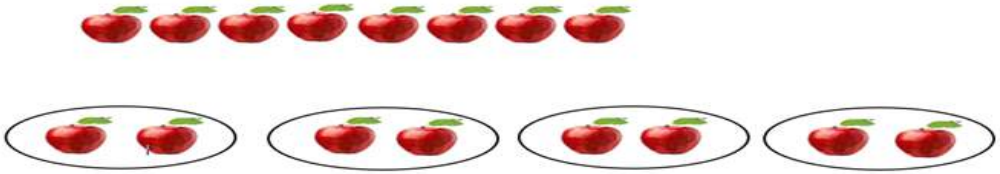
End of Year Objective:

Solve one-step problems involving division by calculating the answer using concrete objects, pictorial representations and arrays.

In year one, children will continue to solve division problems using practical equipment and jottings. They should use the equipment to share objects. 'If six football stickers are shared between two people, how many do they each get?' They may solve both of these types of question by using a 'one for you, one for me' strategy until all of the objects have been given out.



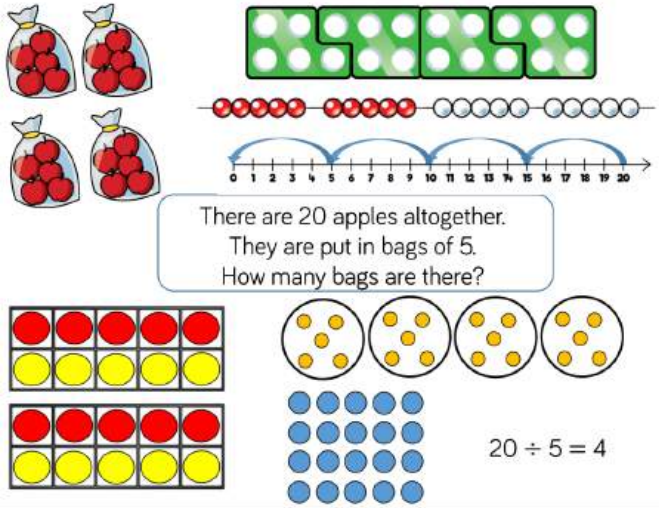
Children should use equipment to group objects and count the number of groups.

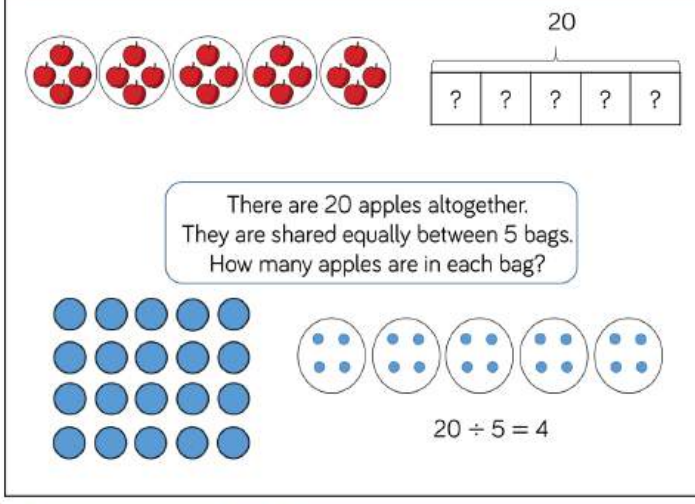


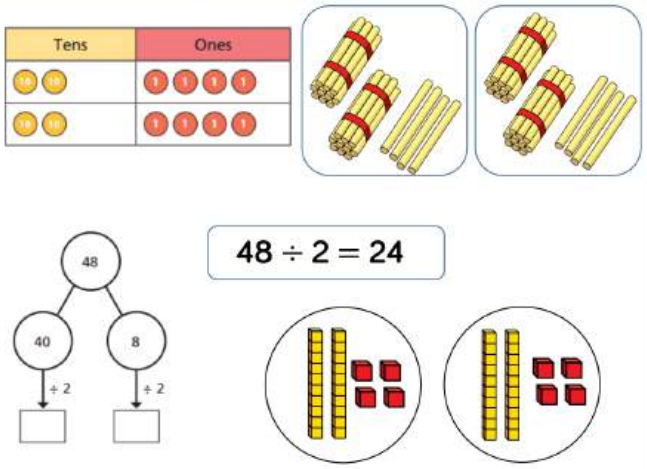
8 ÷ 2 = 4 (children are not expected to record formal division calculation)

Children should be introduced to the concept of simple remainders in their calculations at this practical stage, being able to identify that the groups are not equal and should refer to the remainder as '… left over'. This process is vitally important for children to understand abstract remainders later on in the curriculum.

Year 1:

Skill: Solve 1-step problems using division (grouping)	Year: 1/2
	Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line. They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division.

Skill: Solve 1-step problems using multiplication (sharing)	Year: 1/2
	Children solve problems by sharing amounts into equal groups. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally. In Year 2, children are introduced to the division symbol.

Skill: Divide 2-digits by 1-digit (sharing with no exchange)	Year: 1/2
	When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones. Straws, Base 10 and place value counters can all be used to share numbers into equal groups. Part-whole models can provide children with a clear written method that matches the concrete representation.

Year 2:

End of Year Objective:

Calculate mathematical statements for division within the multiplication tables and write them using the division (÷) and equals (=) signs.

Children will utilise practical equipment to represent division calculations as grouping (repeated subtraction) and use jottings to support their calculation, e.g.

12 ÷ 3 =

Children need to understand that this calculation reads as 'How many groups of 3 are there in 12?'

They should also continue to develop their knowledge of division with remainders, e.g.

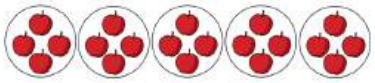
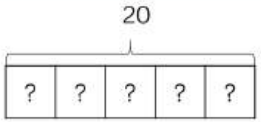
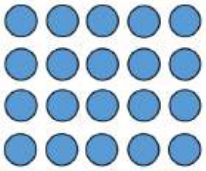
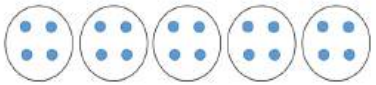
13 ÷ 4 =

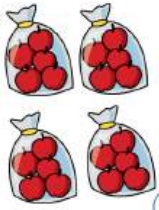
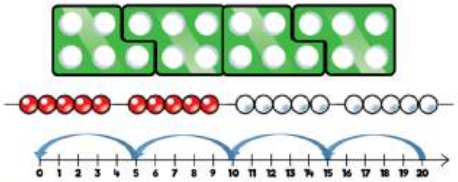
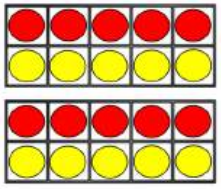
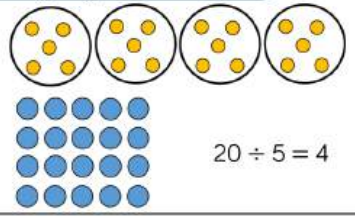
13 ÷ 4 = 3 remainder 1

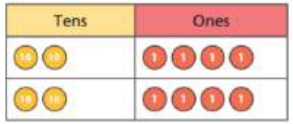
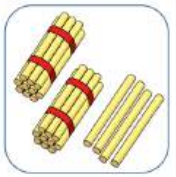
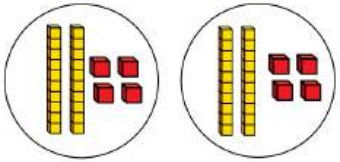
Children need to be able to make decisions about what to do with remainders after division and round up or down accordingly. In the calculation 13 ÷ 4, the answer is 3 remainder 1, but whether the answer should be rounded up to 4 or rounded down to 3 depends on the context, as in the examples below:

I have £13. Books are £4 each. How many can I buy?
Answer: 3 (the remaining £1 is not enough to buy another book)

Apples are packed into boxes of 4. There are 13 apples. How many boxes are needed?
Answer: 4 (the remaining 1 apple still needs to be placed into a box)

Skill: Solve 1-step problems using multiplication (sharing)	Year: 1/2
  There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?   $20 \div 5 = 4$	Children solve problems by sharing amounts into equal groups. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally. In Year 2, children are introduced to the division symbol.

Skill: Solve 1-step problems using division (grouping)	Year: 1/2
  There are 20 apples altogether. They are put in bags of 5. How many bags are there?   $20 \div 5 = 4$	Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line. They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division.

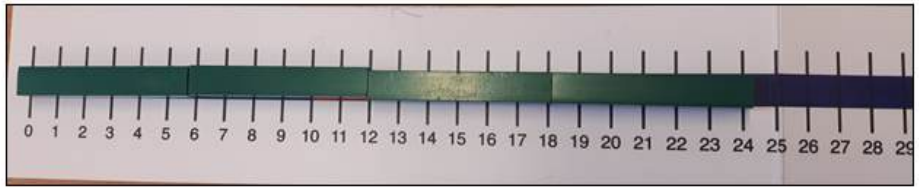
Skill: Divide 2-digits by 1-digit (sharing with no exchange)	Year: 1/2
   $48 \div 2 = 24$ 	When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones. Straws, Base 10 and place value counters can all be used to share numbers into equal groups. Part-whole models can provide children with a clear written method that matches the concrete representation.

Year 3:

End of Year Objective:

Write and calculate mathematical statements for division using the multiplication tables that they know, including for two-digit numbers divided by one-digit numbers, progressing to formal written methods.

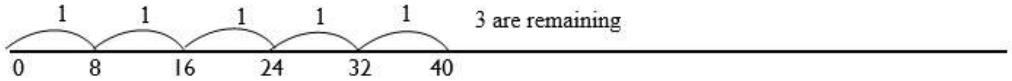
Initially, children will continue to use division by grouping (including those with remainders), where appropriate linked to the multiplication tables that they know (2, 3, 4, 5, 8 and 10), e.g.



In this way, children can see remainders using the concrete materials, eg

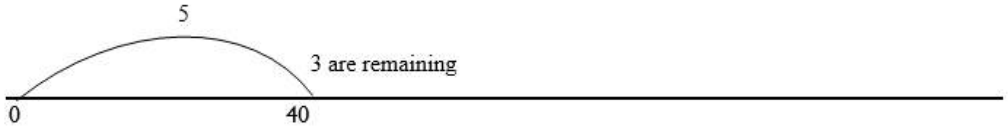
Children will then move on to recording their calculations on a blank number line, eg

43 ÷ 8 =



43 ÷ 8 = 5 remainder 3

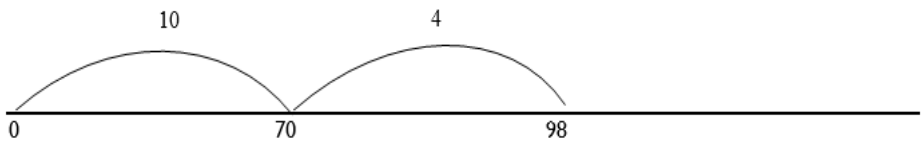
Pupils need to have a solid grasp of their tables and related division facts. When they are able, they can 'chunk their jumps'.



When dividing larger two digit numbers, children should be encourage to look for the multiple of 10 and 'chunk their jump'

Eg

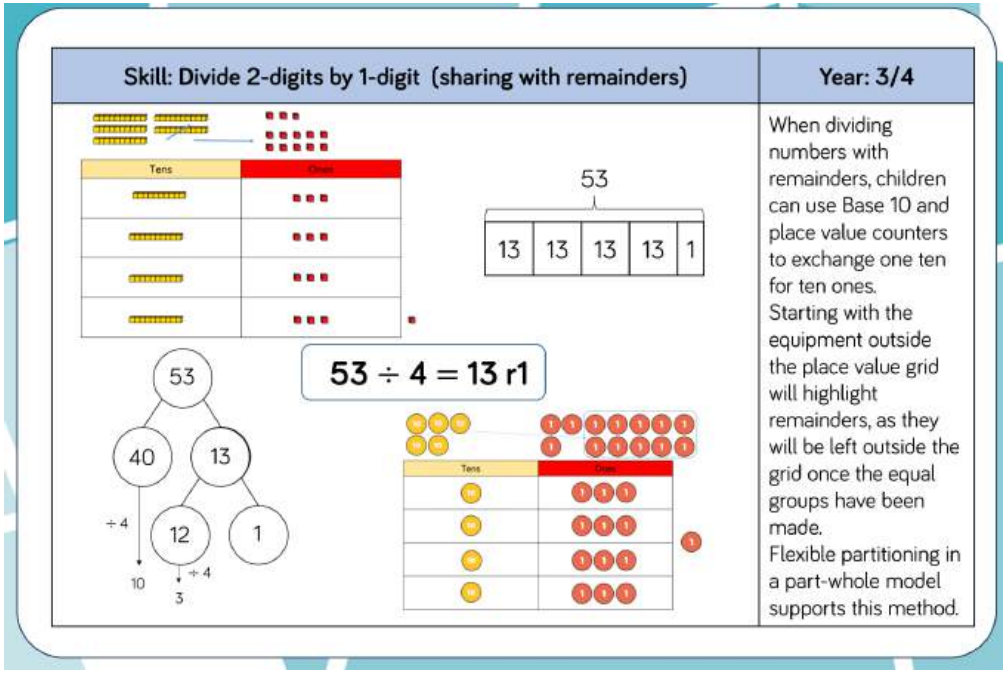
98 ÷ 7 becomes

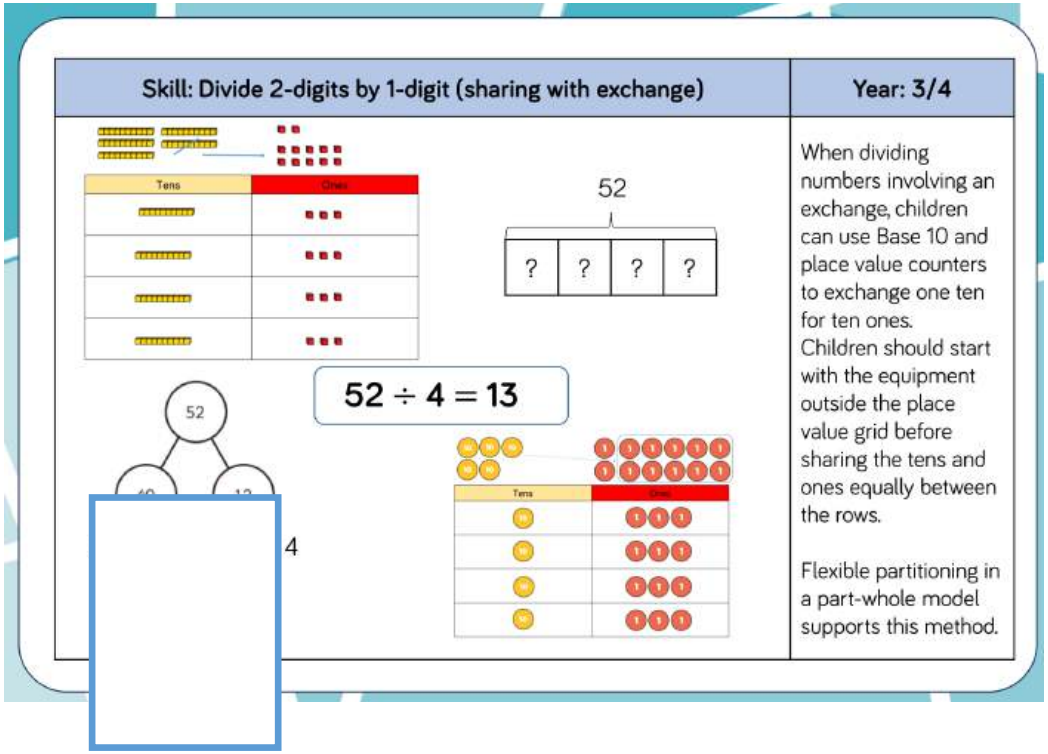


Single jumps can be used (if needed) after the jump of ten. Jumping this larger 'chunk' at the start, prepares them well for dividing larger numbers mentally later in the curriculum.

Children should be able to solve real life problems including those with money and measures. They need to be able to make decisions about what to do with remainders after division and round up or down accordingly.

Year 3:





Children should also be using the bar model to divide, drawing on their knowledge of time tables.

Year 4:

End of Year Objective:

Divide numbers up to 3 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.

Pupils will move on to the division of a 2-digit number by a 1-digit number using the bus stop method. Pupils record the answer above the line.

98 ÷ 7 becomes

```
   1  4
  ---
7 | 9  8
    2
```

Answer: 14

Ensure children understand the importance of place value when using this method. Lots of teacher led talked through examples will be necessary.

Pupils continue to use the bus stop method and need to know that some calculations have a remainder.

432 ÷ 5 becomes

```
      8  6  r2
  ------
5 | 4  3  2
      3
```

Answer: 86 remainder 2

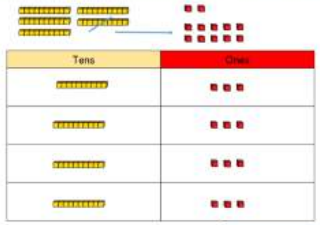
They need to be able to make decisions about what to do with remainders after division and round up or down accordingly particularly in word problems.

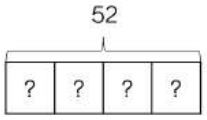
Children should be able to solve real life problems including those with money and measures.

Example: Mr Smith is putting eggs in boxes. Each box holds 6 eggs. He has 80 eggs altogether. How many complete boxes can Mr Smith fill? How many eggs are left over?

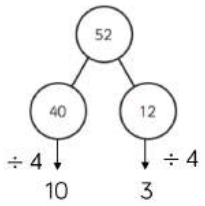
Skill: Divide 2-digits by 1-digit (sharing with exchange)

Year: 3/4





52 ÷ 4 = 13



10 + 3 = 13

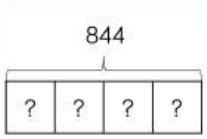
When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones.
Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows.

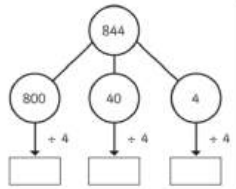
Flexible partitioning in a part-whole model supports this method.

Skill: Divide 3-digits by 1-digit (sharing)

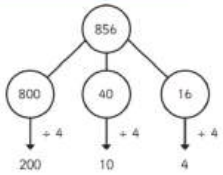
Year: 4

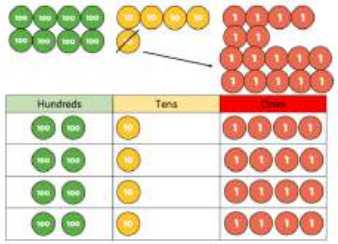
844 ÷ 4 = 211





844 ÷ 4 = 211

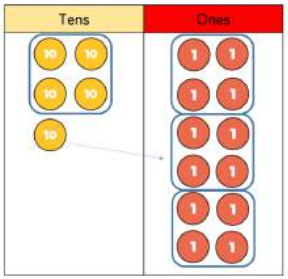


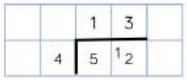


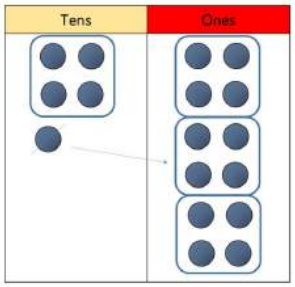
Children can continue to use place value counters to share 3-digit numbers into equal groups.
Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows.
This method can also help to highlight remainders.
Flexible partitioning in a part-whole model supports this method.

Skill: Divide 2-digits by 1-digit (grouping)

Year: 4/5







52 ÷ 4 = 13

When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor.

Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?'

Remainders can also be seen as they are left ungrouped.

Year 5:

End of Year Objective:

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

Pupils will work through some harder examples including dividing 4-digit numbers by a 1-digit number.

$$5\overline{)4^{4}3^{3}2^{2}4} = 8\ 6\ 4\ \text{r}4$$

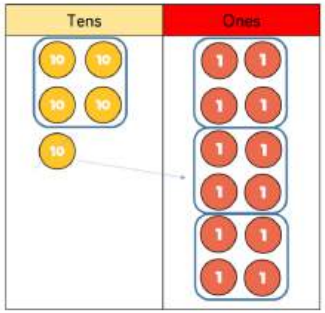
Ensure children have a solid grasp of what they are doing and have a rough estimate about whether their final answer is reasonable or not.

They need to be able to make decisions about what to do with remainders after division and round up or down accordingly.

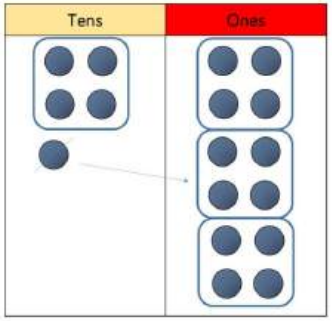
Children should be able to solve real life problems including those with money and measures.

Skill: Divide 2-digits by 1-digit (grouping)

Year: 4/5



		1	3	
	4	5	$^{1}2$	



$52 \div 4 = 13$

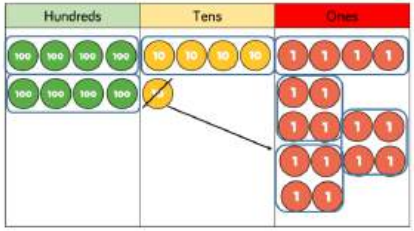
When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor.

Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?'

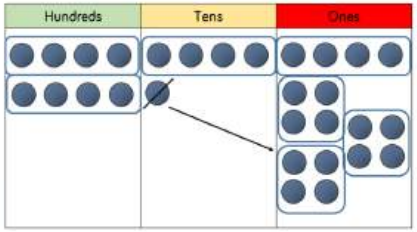
Remainders can also be seen as they are left ungrouped.

Skill: Divide 3-digits by 1-digit (grouping)

Year: 5



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



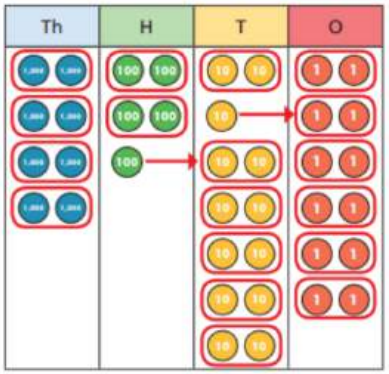
$856 \div 4 = 214$

Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number.

Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.

Skill: Divide 4-digits by 1-digit (grouping)

Year: 5



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

$8{,}532 \div 2 = 4{,}266$

Place value counters or plain counters can be used on a place value grid to support children to divide 4-digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method.

Children should be encouraged to move away from the concrete and pictorial when dividing numbers with multiple exchanges.

Year 6:

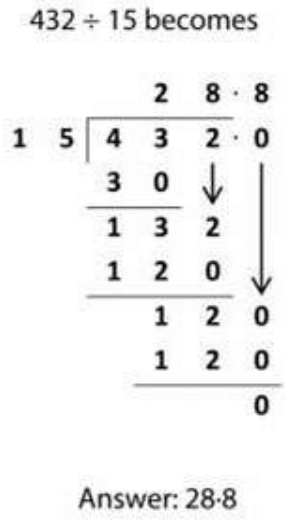
End of Year Objective:

Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context.

Use written division methods in cases where the answer has up to two decimal places.

Once secure with short division, Pupils will move on to long division.

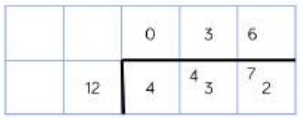
To develop division further, it should be extended to include dividing a four-digit number by a two-digit number.



Children should be able to solve real life problems including those with money and measures. They need to be able to make decisions about what to do with remainders after division and round up or down accordingly.

Year 6:

Skill: Divide multi digits by 2-digits (short division)	Year: 6



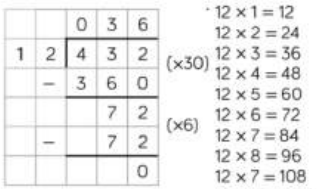
$432 \div 12 = 36$

$7{,}335 \div 15 = 489$

15	30	45	60	75	90	105	120	135	150

When children begin to divide up to 4-digits by 2-digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Skill: Divide multi-digits by 2-digits (long division)	Year: 6



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

$432 \div 12 = 36$

$7{,}335 \div 15 = 489$

1 × 15 = 15
2 × 15 = 30
3 × 15 = 45
4 × 15 = 60
5 × 15 = 75
10 × 15 = 150

Children can also divide by 2-digit numbers using long division.

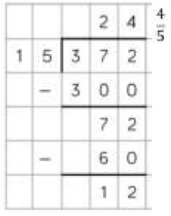
Children can write out multiples to support their calculations with larger remainders.

Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Skill: Divide multi digits by 2-digits (long division)	Year: 6

$372 \div 15 = 24$ r12

1 × 15 = 15
2 × 15 = 30
3 × 15 = 45
4 × 15 = 60
5 × 15 = 75
10 × 15 = 150



$372 \div 15 = 24\frac{4}{5}$

When a remainder is left at the end of a calculation, children can either leave it as a remainder or convert it to a fraction. This will depend on the context of the question.

Children can also answer questions where the quotient needs to be rounded according to the context.

Division: Important reminders…

Children have got to be secure with their multiplication facts – use of concrete materials is vital to consolidate this understanding.

Our aim is that by the end of Y6 children use mental methods (with jottings) when appropriate, but for calculations they cannot do in their heads, they use an efficient formal written method accurately.

Children need to be exposed to the wide selection of mathematical language used for division.

If at any time, pupils are making errors or are showing a lack of understanding, return to the previous stage in calculation.