Written Calculation Policy for Addition

Step 1 (Normally Reception)

Concrete addition

This step requires the children to combine two groups of objects or images.

Count out 3, add two more. How many do we have now?

Use of fingers is encouraged as this is a constantly available resource.

The number sentence should be related to the objects/pictures/fingers whenever possible.

Children are encouraged to hold the biggest number in their head and count on the other number.

For example: 3 + 2 = 5

For example 5 + 1 = 6

Step 2 - Number Lines (Normally Year 1 to Year 2)

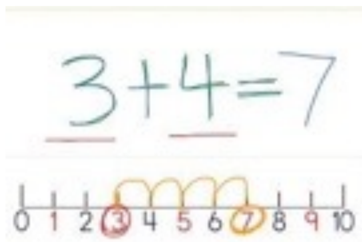
Numbered Number Line

This step requires the children to first count "one more" and then "several more" than a given number They use a numberline by circling the starting number, then counting on the second.

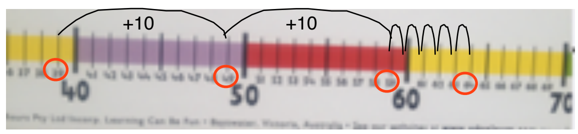
The use of number lines may develop from number lines to 20, next up to 50, then up to 100.

Children will move through these stages:
U+U
TU+U
TU+T
TU+TU

It is important that children are able to count on in tens mentally from any 2 digit number.



Here's an example of TU+TU
E.g. 39+25



Written Calculation Policy for Addition

Step 2 - Base 10 Partitioning (Normally Year 2) (part 'a' starts in year 1)

Adding by partitioning using base 10

(Children develop understanding of the value of each digit)

a) Where units add to less than 10.

Children add TU+U, TU+T then TU +TU

This steps requires the children to find each number using base 10, organise the numbers above each other (as shown), then total each part.

E.g. 53+16 =

The calculation be may set out vertically because children are organising it this way using base 10

53
+16

This is not a formal column methods of addition

Children verbally count the tens to make 60

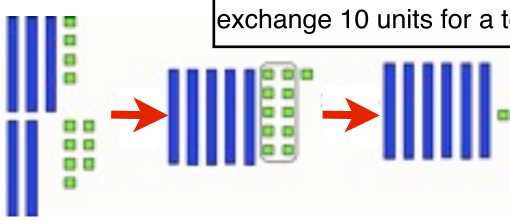
Then total the units to make 9. Then they combine to make 69

b) **Where units add to more than 10.**

When the units add to more than 10, children must take 10 of the units and '*exchange'* for a ten rod.

E.g. 34+27

As the units total more than 10, they exchange 10 units for a tens rod.



Step 3 Part A- Empty Number Lines (Normally Year 2 & Year 3)

Empty number line

This step requires the children to record addition on a blank number line which they draw using a ruler.

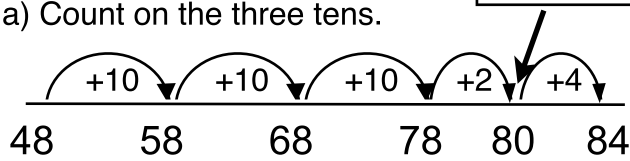
Children are taught to bridge through a multiple of ten where necessary (see examples).

Use **adjusting** to make calculations easier. If the number being added is nearly a multiple of ten, then add the multiple of ten and subtract the difference. If you are adding 36, add 40 then subtract 4. (See example 'c')

E.g. 48 + 36 = 84

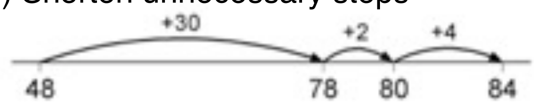
a) Count on the three tens.

Bridging through the multiple of 10

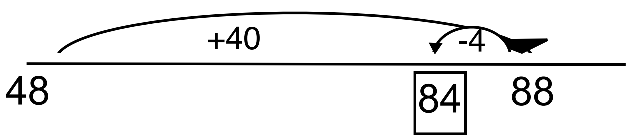


Then add the 6 units, using number bond knowledge to bridge to the next multiple of 10 where necessary.

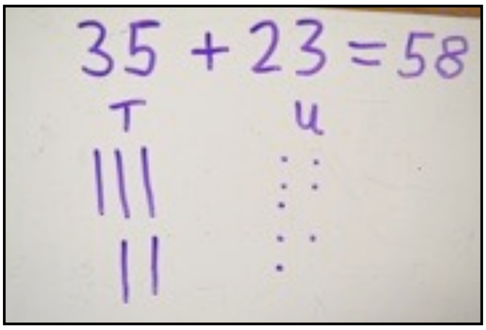
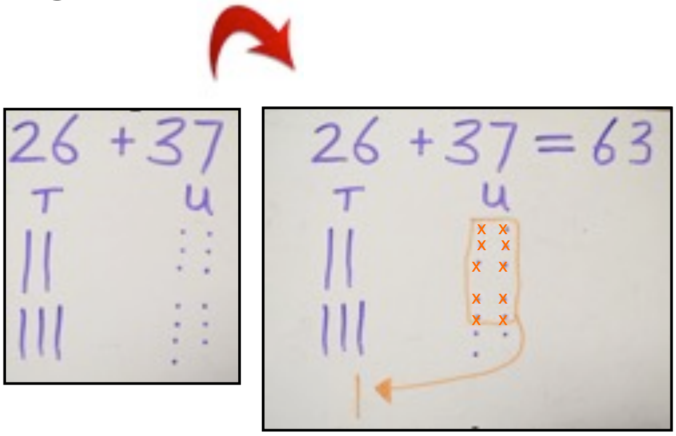
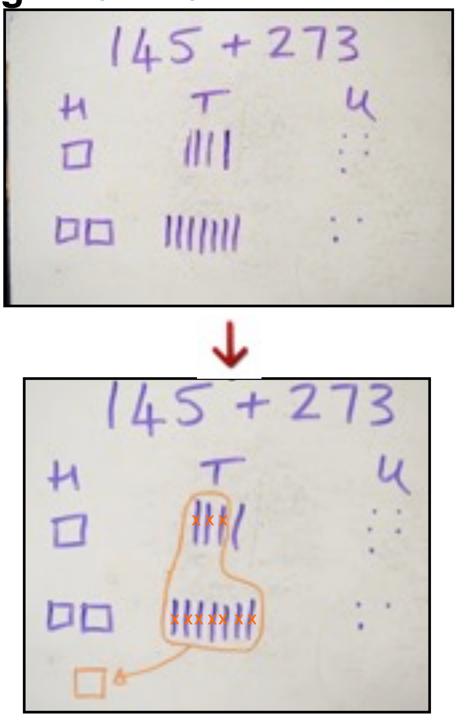
b) Shorten unnecessary steps



c) Use adjusting E.g. 48+36



Written Calculation Policy for Addition

Step 3 Part B - Base 10 Drawings (Normally Year 2 & Year 3)	
Adding by partitioning using base 10 drawings a) **Where units add to less than 10.** (TU+U, TU+T then TU+TU) First draw 35 as a base 10 drawing.Then draw 23 underneath. Count the total (tens then units).	**E.g. 35+23** 
b) **Where units add to more than 10.** First draw the calculation as shown. Next children cross out 10 units and circle around them in a different colour. **Exchange** them for a ten rod by drawing an extra rod in the tens column with an arrow showing it has been exchanged.	**E.g. 26+37** 
c) **Where tens add to more than 10.** First draw the calculation as shown. Next cross out ten of the tens in a different colour. Circle them and **exchange** them for a hundred square by drawing an extra square in the hundreds column with an arrow showing it has been exchanged. **These base 10 drawings prepare children for step 5.**	**E.g. 145+273**  The final answer then is 418.

Written Calculation Policy for Addition

Step 4 (Normally Year 3 & Year 4 as a bridge if required)

Extended Column Method

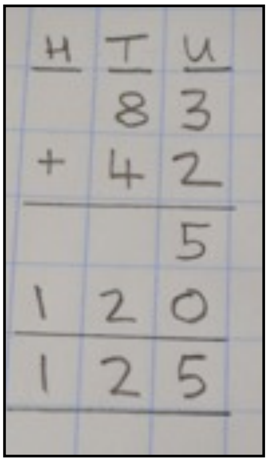
This step requires the children to set the calculation out in a column (being careful to ensure correct place value).

Column headings help children to correctly organise the numbers.

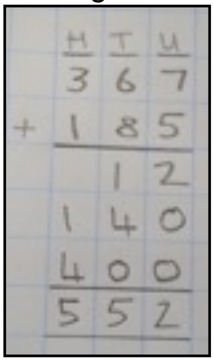
They are then required to add the **lowest value digit first**, recording the answer below before moving to the other digits and adding the partial sums.

This method can be used when adding 2, 3 or 4 digit numbers as well as decimals

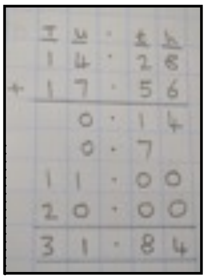
Two digit Numbers



Three digit Numbers



Decimal Numbers



The decimal point has a column of it's own which should continue down to the answer

Step 5
(Where appropriate in Year 3 - up to 3 digit numbers
Year 4 - Up to 4 digit numbers
Year 5 - More than 4 digits)

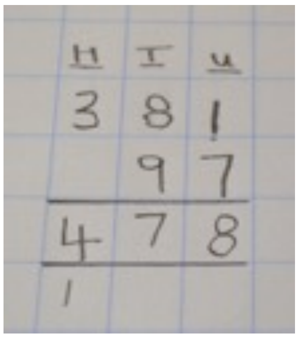
Standard Column Method

This method requires the children to set the calculation out in a column (being careful to ensure correct place value).

When adding the **children are required to use correct language** such as '8 tens add 9 tens makes 17 tens which is 170. Write the hundred, below the line in the hundred's column and write the 7 tens in the tens column'.

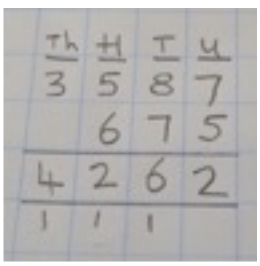
This method should be extended to addition of 3, 4 and 5 digit numbers as well as decimal numbers.

The method can also be extended to adding more than two numbers

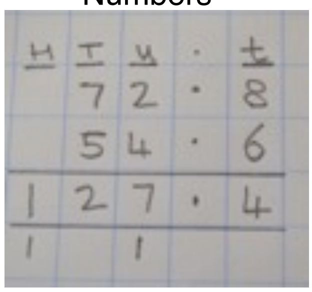


Exchanged tens are written underneath the line.

Larger Numbers



Decimal Numbers



Written Calculation Policy for Subtraction

Step 1 (Normally Reception)

Concrete subtraction

This step requires children to physically take away one or more objects from a set of objects.

For example: Take away two. How many are left?

Children will also cross out images to take away.

5 - 2 = 3

Use of fingers is encouraged as this is a constantly available resource.

The number sentence should be related to the objects/pictures/fingers whenever possible.

5 - 1 = 4

5 - 1 = 4

Step 2 - Number Lines (Normally Year 1 to Year 2)

Counting back on numbered number lines

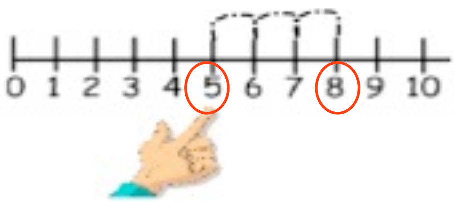
This step requires the children to use a numbered number line to work out one less or several less.

They circle the starting number then count back, before circling the number they end on.

The use of number lines may develop from number lines to 20, next up to 50, then up to 100.

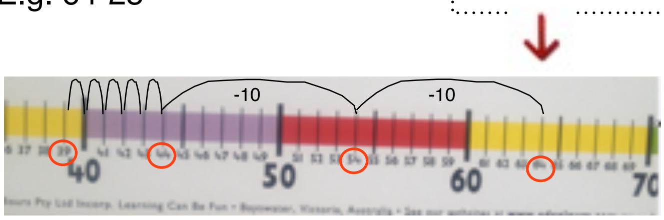
Children will move through these stages:
U-U, TU-U, TU-T & TU-TU

E.g. 8-3=



Here's an example of TU-TU
E.g. 64-25

Start here.
Count back
tens then units



Written Calculation Policy for Subtraction

Step 2 Base 10 (Normally Year 1 to Year 2)

Subtracting by partitioning using base 10

a) Where units subtract easily

Children subtract TU-U, TU-T then TU-TU

This steps requires the children to find the starting number, then subtract from it.

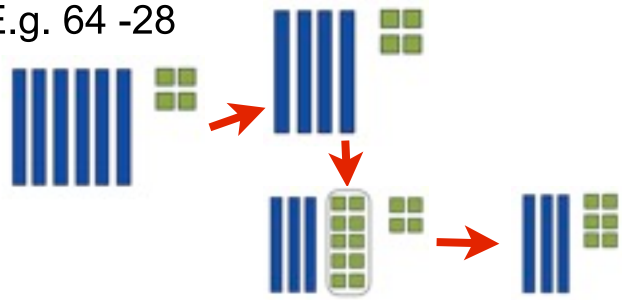
E.g. 37 -15

Find 37. Then take away the ten and the five units to see what is left.

b) **Where subtraction of units requires 'exchanging' a ten**

Where units can't be subtracted from units because there aren't enough in the starting number, one of the tens rods should be exchanged for ten units.

E.g. 64 -28



Find 64 in base 10. Two tens rods can be taken away, but 8 units cannot UNLESS you first exchange a rod for 10 units.

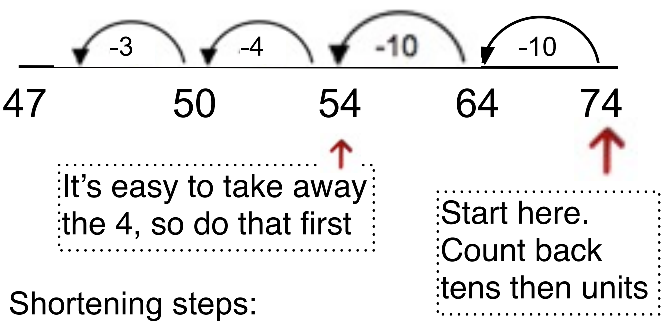
Step 3 Part A - Empty Number Lines (Normally Year 2 & Year 3)

Counting back on blank number lines

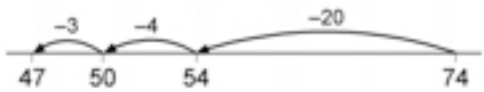
This step requires the children to count backwards using a blank number line bridging through a multiple of ten if necessary.

The number of jumps or steps can be reduced as the children become more proficient.

E.g. 74 - 27 = 47

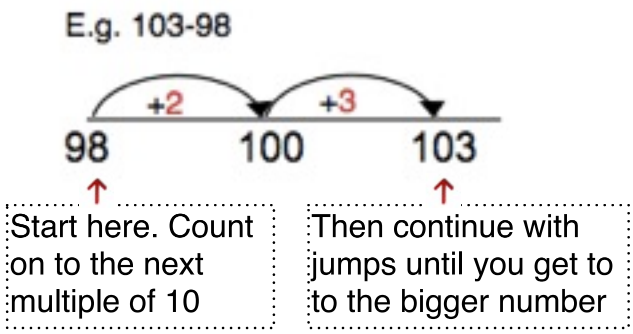


Shortening steps:



Finding the difference by counting on

Children will be taught that it is easier to count on to find the 'difference' if the numbers are close together. E.g. 103-98, 432-398 etc. Here children may draw an empty number line to help them record their working.



Step 3 Part B - Base 10 Drawings (Normally Year 2 & Year 3)

Subtracting using base 10 drawings

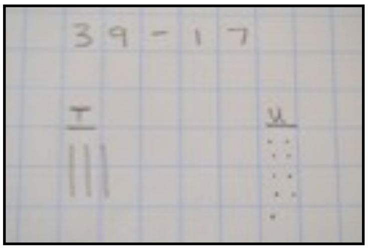
a) **Where units subtract without the need to 'exchange' a ten**

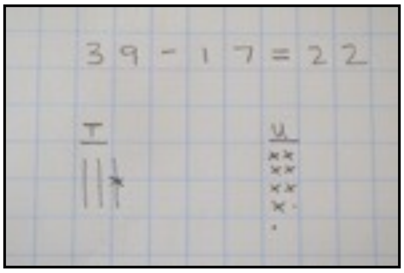
(TU-U, TU-T then TU-TU)

First draw the starting number.

Next cross out the tens to be taken away, followed by the units.

E.g. 39-17





First cross out 1 ten, followed by 7 units.

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b) **Where subtraction of units requires 'exchanging' a ten**

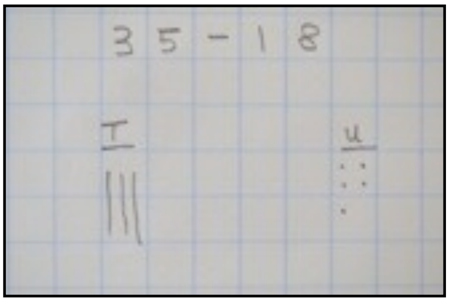
First draw the starting number.

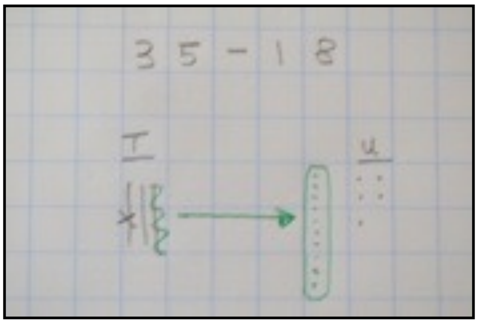
Next cross out the ten. Children should now notice that they cannot take away enough units because there aren't enough in the drawing.

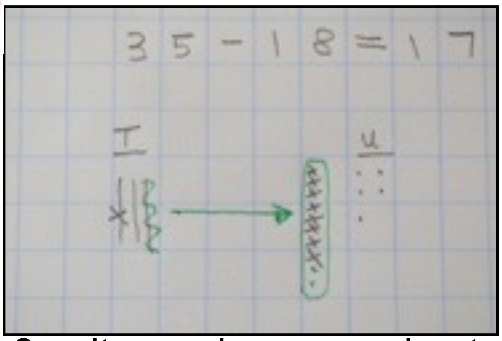
Therefore they need to 'exchange' a ten rod for ten units. They cross out a ten rod with a wiggly green line and add 10 units in a line as shown to the left of the original units.

Now there are enough units so they subtract the required amount. They must now carefully total the remaining tens and units.

E.g. 35- 18







Now 8 units can be crossed out followed by 1 ten.

The answer they are left with is 15.

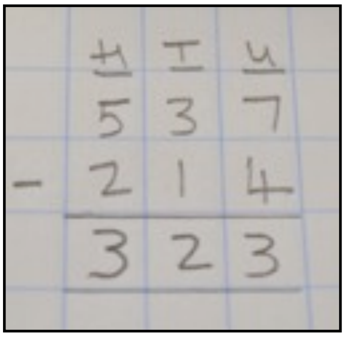
Step 5
(Where appropriate in Year 3 - up to 3 digit numbers
Year 4 - Up to 4 digit numbers
Year 5 - More than 4 digits and decimal numbers)

Standard Formal Method (decomposition)

a) Exchanging not required

This step requires the children to set the calculation out in a column (being careful to ensure correct place value) with the largest number on the top. Column headings help children to keep numbers in the correct column.

They should subtract the right hand column first, in this example subtracting 7-4, writing 3 underneath.

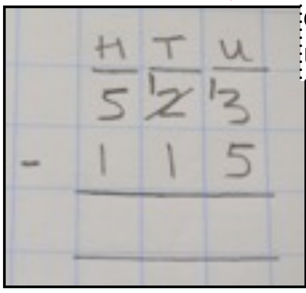


Again correct use of language should always be used, for example, 3 tens take away 1 ten is 2 tens.

b) Where exchanging is required

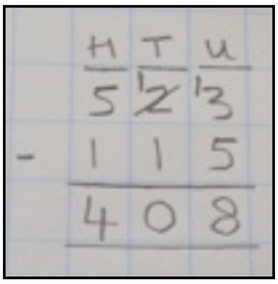
If there aren’t enough units (e.g. 3-5), then a ten must be **exchanged**. Here one ten will be moved to the units column, leaving one ten less in the tens column. (See example)

You can’t take 5 from 3 so need to exchange one of the tens for an extra ten units



Now you can calculate the units (13-5)

Now the columns can be subtracted.

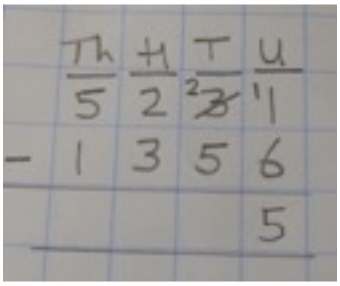


The tens and hundreds here subtract more easily

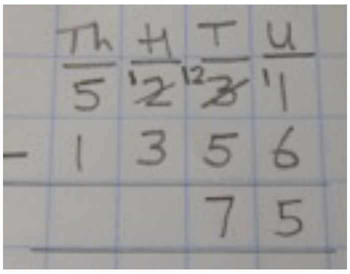
This method can be used for any number of digits as we as decimals.

Step 5
(Examples involving larger numbers, decimal numbers and tricky questions)

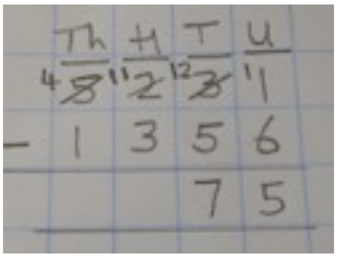
Larger Numbers



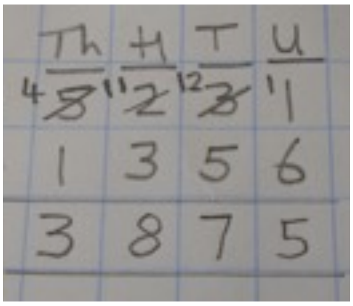
A ten must be exchanged for an extra ten units.



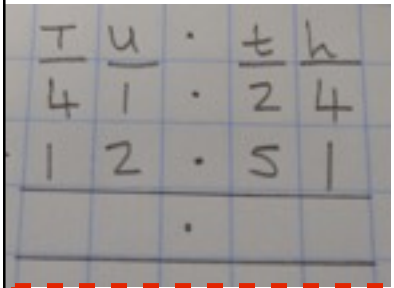
Not enough tens to subtract 5 means that a hundred must be exchanged for ten tens.



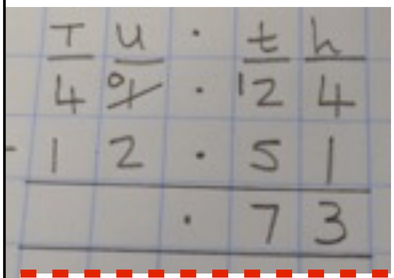
Not enough hundreds means a thousand must be exchanged for ten hundreds.



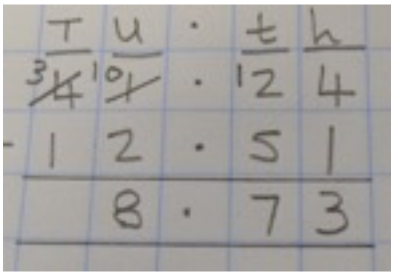
Decimal Numbers



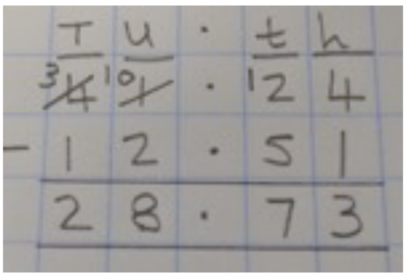
The decimal place should be kept in the same place all the way down as shown.



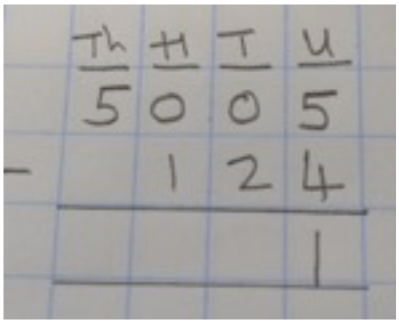
As there aren't enough tenths for the subtraction to take place, a unit must be exchanged for ten tenths.



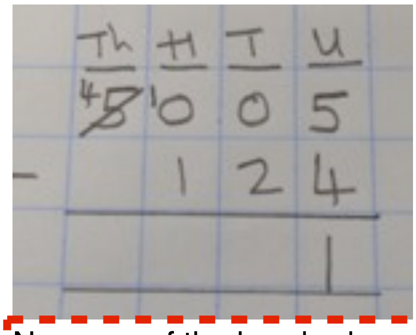
There are now no units left to complete this part of the calculation, so a ten should be exchanged for ten units.



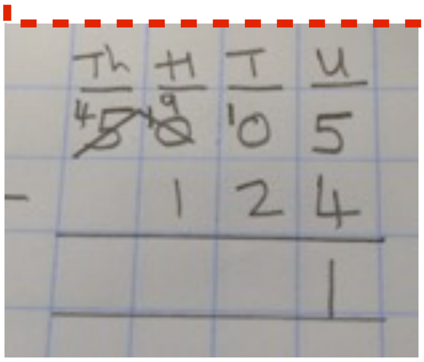
Tricky Numbers

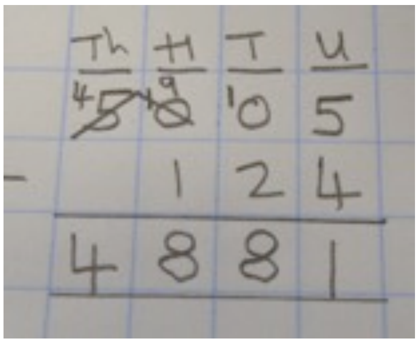


There aren't any tens so a hundred needs to be exchanged. There aren't any hundreds so a thousand must first be changed to ten hundreds.



Now one of the hundreds can be exchanged for ten tens, leaving 9 hundreds left.





Written Calculation Policy for Multiplication

Step 1 (Normally Reception to Year 1)

a) Concrete Multiplication in problem solving contexts

Using real objects, children might solve problems such as. Each child has 2 teddies. Shall we give them out and see how many Karen, Clare and Ian will get on their table.

B) Doubling

Children explore doubling and try to learn doubles (especially up to double 5). They use a variety of resources, including dominos and fingers.

c) Counting in 2s, 5s and 10s.

Rote counting with the support of number lines helps children develop in this.

For example:

Step 2 - Grouping objects and using counting boards (Year 1)

Children may represent problems using real objects or counters/cubes to represent them.

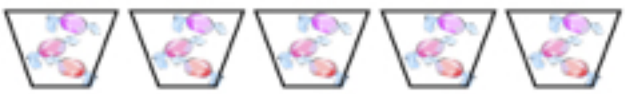
E.g. Sam puts 3 sweets into each cup. How many sweets will he put in the cups?

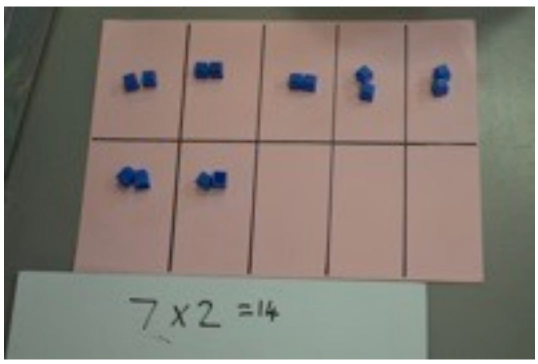
In this step, children will be introduced to the language and symbols of multiplication.They will be introduced to written calculations e.g. 4x2 and will interpret this as “4 lots of 2”.

<u>Using Counting Boards</u>

Children may solve questions like 4x5, by arranging cubes on a Counting Board.

Children will use real cups and objects or counters to represent the sweets.



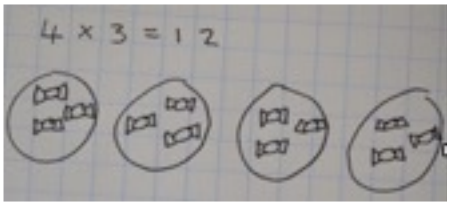


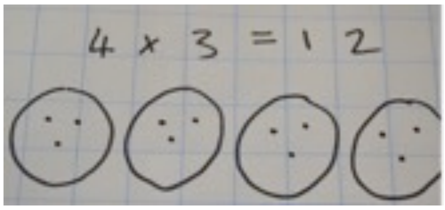
Written Calculation Policy for Multiplication

Step 3 Part A - Pictures and drawings (Year 1 to Year 2)

Children may represent a problem using a drawing.

When children are ready, they should move onto more abstract drawings, e.g. representing sweets as dots in circles.





Step 3 Part B Arrays (Normally Year 1 to Year 2)

Arrays Using Pictures & Counters

This step requires the children to use objects or pictures in arrays. They should understand that this is just a way to organise drawings neatly so problems can be solved accurately.

Counters may be used next.

For example:

2 x 3 (2 lots of 3 so 2 rows of 3)

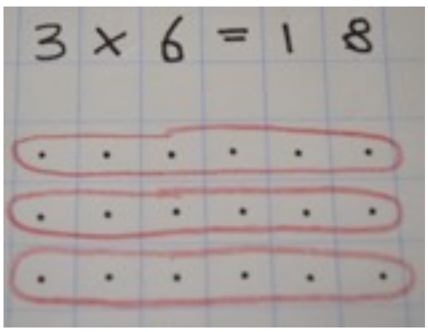
E.g.3 x 6 = (3 lots of 6 so 3 rows of 6)

Drawn Arrays (Year 2 & Year 3)

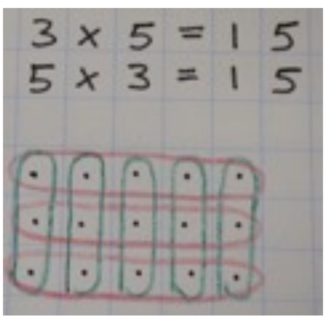
Children should then be taught to draw arrays using dots in their books. One dot should be drawn in each square.

Problems should be set in real life contexts wherever possible.

Arrays will be used to support children's understanding of how multiplication can be done in any order. Children can then find related facts and solve missing number problems.

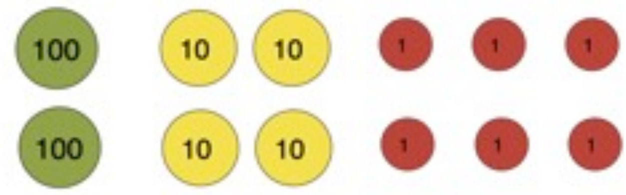
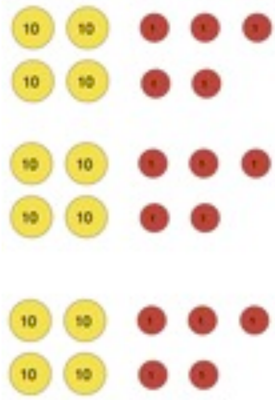
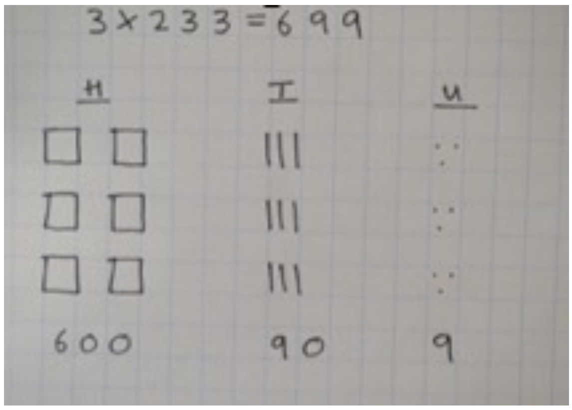
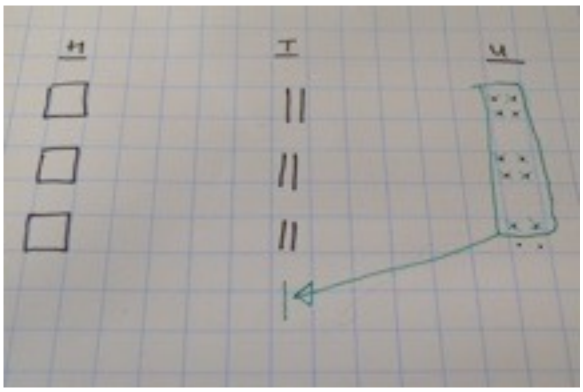


One dot per square



Red groups show 3x5, green groups show 5x3.
The total number of dots is the same.

Written Calculation Policy for Multiplication

Step 4 - Multiplying bigger numbers using Place value tiles or base 10 drawings (Y2-Y3)	
Place value counters Line up the counters in columns. This shows 2x123	
Exchanging If there are enough units to exchange for a tens counter, children will be expected to do so. If there are enough tens counters to exchange for a hundred counter, children will be expected to do so.	E.g. 45x3 Ten of the units would be exchanged for a ten counter. Ten of the tens counters would be exchanged for a hundreds counter. 
Base 10 drawings Stick to columns as shown, drawing three lots of 123. Exchanging may need to be done as modelled in the addition section. **Exchanging** In the same way that children exchanged when adding, they would be expected to here as well.	 E.g. 124 x 3 

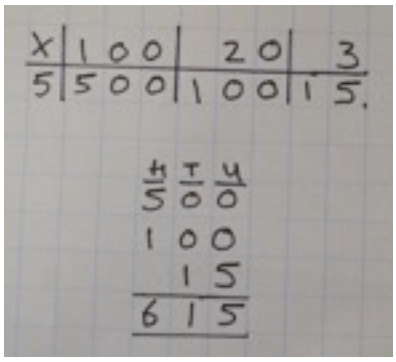
Written Calculation Policy for Multiplication

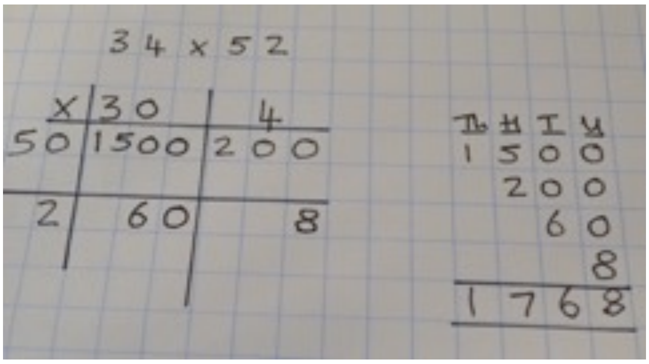
Step 5 (Y3 - begin using UxTU,)
(Y4 - UxTU & UxHTU, TUxTU?)
(Y5 - up to ThHTUxU or TU)

Grid Method

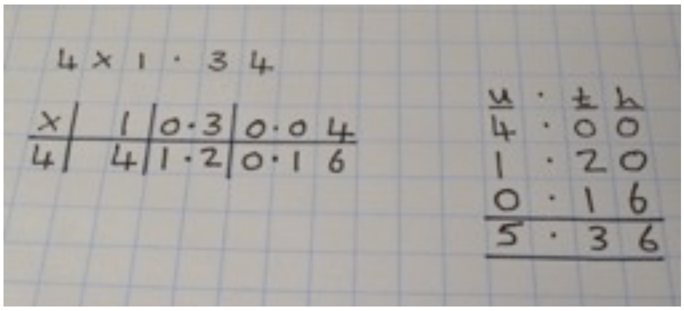
This step requires the children partition the numbers and place them into a grid. This method should be used for multiplication by one and two digit numbers and can be extended to include decimals.

E.g. 5x123



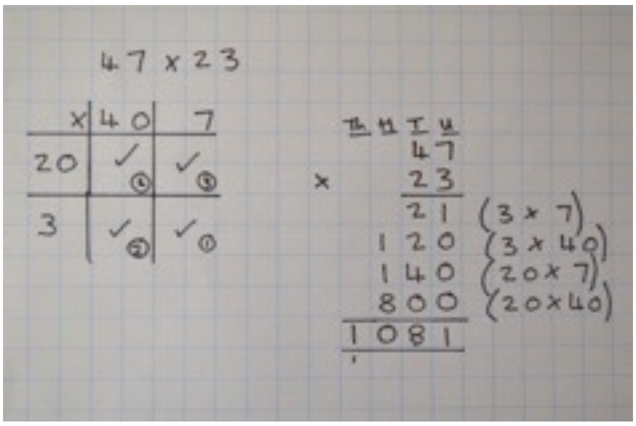


Decimal Numbers



Grid Method Bridge

Once the grid method is secure (Including TUxTU), children should use it as a tick list to check they have included all of the calculations they need to in the formal method. They should follow the order as shown by the circled numbers.



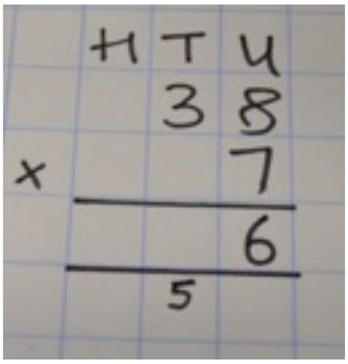
Written Calculation Policy for Multiplication

Step 6 - (Normally Year 4 onwards)

Short Method for x U

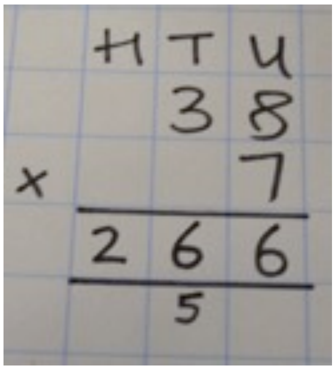
This step requires the children to use carrying to shorten the method.

First multiply the units by 7 (8x7). The answer is 56 so the 50 is moved to the tens column (under the line).

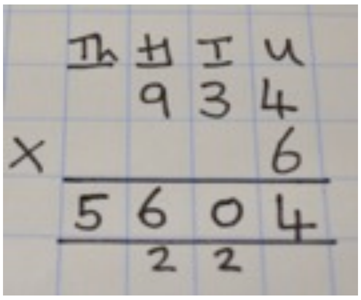


Next multiply the tens by 7. Correct language should be used ‘7 lots of 3 tens is 21 tens, plus the 5 tens underneath is 26 tens which is 260’.

Write the 200 in the hundreds column and the 60 in the tens.



This can be extended to larger numbers.

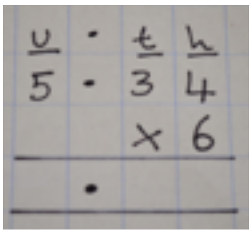


This can also be extended to decimal numbers.

First set the calculation vertically, ensuring the columns line up correctly (labelling them helps identify them).

Use language such as “4 hundredths times 6 is 24 hundredths. Put the 4 in the hundredths column and exchange the 20 hundredths for 2 tenths.”

1.



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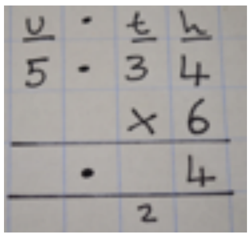

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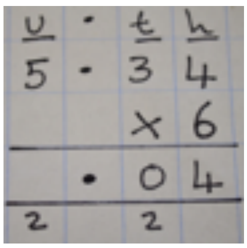

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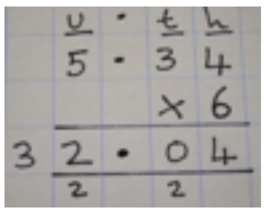


Written Calculation Policy for Multiplication

Step 8 - (Normally Year 6)

Long Method for TU x TU or HTUxTU or ThHTUxTU

1) Write the calculation vertically as shown

2) Multiply the 7 units by 6 units to make 42 units. The 2 can be written in the units column, the 4 tens must be noted above in the tens column to be **added** later.

3) Next we multiply 7 by 5 tens. 7x5 tens is 35 tens. Now remember we already had 4 tens so now there are 39. Write 39 tens in the answer to make 392.

4) As we will now be multiplying 2 **tens** by 6, there will be no units in this part so we can put a zero in the units column below.

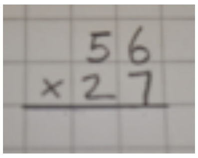
5)Two tens multiplied by 6 is 12 tens. The 2 can be written in while the ten tens (which makes 1 hundred) should be written above the hundreds column to be **added** later.

6) 50x20 can be found by simply multiplying 5x2 with the answer going in the hundreds column. We must remember to add the hundred above, making 11 hundred.

(Once a number above has been added, it must be crossed out)

7) Now total the two calculations to reveal the final answer.

1.



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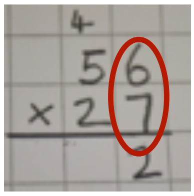

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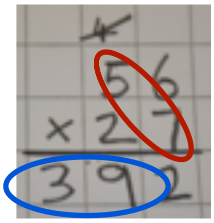

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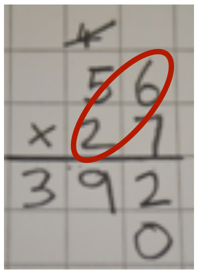

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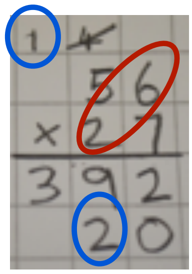

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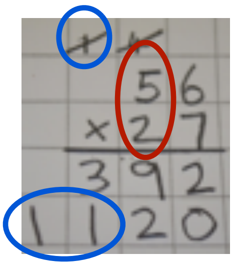

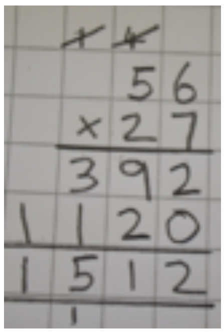

Written Calculation Policy for Division

<table>
<tr><th colspan="2">Step 1 - (Reception)</th></tr>
<tr><td>

Concrete Sharing

The first step requires the children to use objects or images to share.(not really images)

(Language should be extended to: _____ shared by ______)

Problems set in real contexts.

Concrete Grouping

Again the focus is on relevant activities. E.g. Putting 4 stars in each bag. How many bags have we filled using the 12 stars?

</td><td>

12 ÷ 4 = 3

</td></tr>
<tr><th colspan="2">Step 2 - (Normally Year 1)</th></tr>
<tr><td>

Simple Base 10 Sharing

Problems should be set in real life contexts as much as possible.

Children are shown how to represent e.g. the cakes in the problem with base 10 cubes.

(Cdn associate ÷2 with finding half)

Simple Base 10 Grouping

Children will be taught to interpret (in contexts) division such as 25÷5 as ‘How many groups of 5 are in 25?.’

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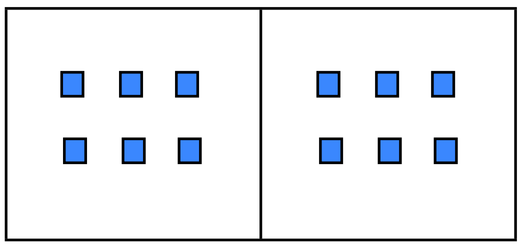
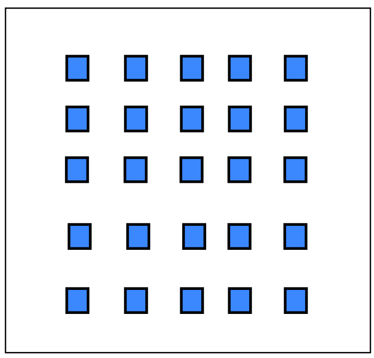
E.g. 12÷2 or half of 12





</td></tr>
</table>

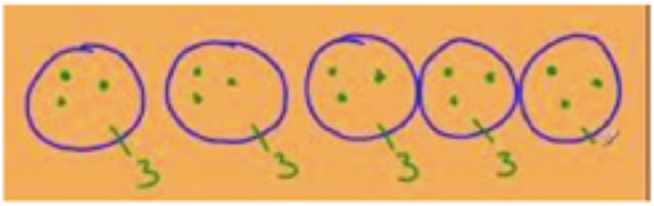
Written Calculation Policy for Division

Step 3 - (Normally Year 1 to Year 2)

Sharing using drawings

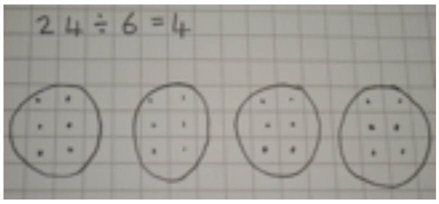
Children draw five circles, and then share out the 15 dots, one at a time between the circles.

E.g. E.g. 15 ÷ 5 = 3



Grouping using drawings

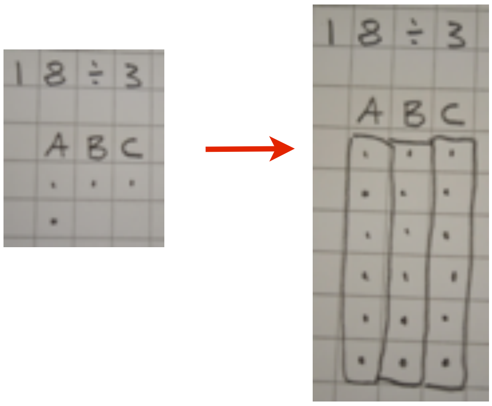
Children draw groups of six until they have used 24 dots. They circle the groups of 6 so they can see how many there are.



Step 4 - (Normally Year 2)

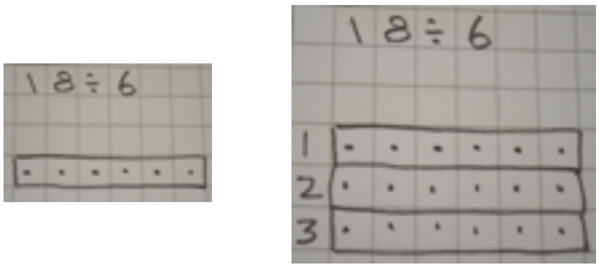
Sharing using Arrays

Children will relate e.g. 18÷3 with sharing between 3 people. They may write the initials of their names (or make them up if unspecified in the question). They will then distribute the total dots next to each initial, one at a time, (one dot per square) until they are all distributed.



Grouping using Arrays

When the context of a question is grouping e.g. eggs are put in boxes with six eggs in each box. How many eggboxes will be filled by 24 eggs; children will draw sets of 6.



Children should be challenged to ask: Can I solve it using my tables knowledge?

Children may be introduced to the concept of division with remainders.

Written Calculation Policy for Division

Step 5a - (Normally Year 3)

Division by sharing using base 10

(for larger numbers)

E.g. 52÷4

The rods can be divided onto the grid. There is a remainder of 1 rod.

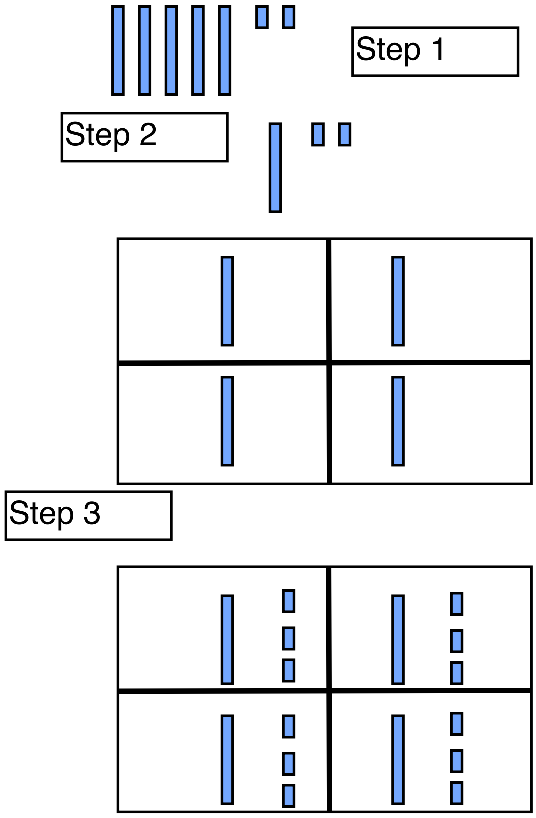
This can then be exchanged for 10 cubes.

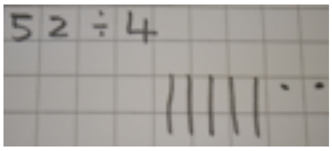
The cubes can be shared one at a time until they are all shared out. Explain that it must be the same number in each group so there may be some remainders.

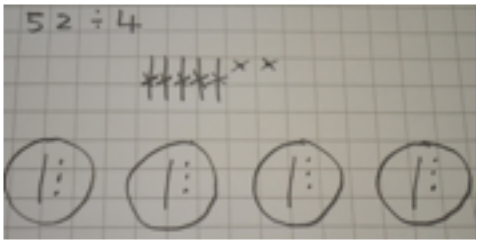
Division (sharing) by base 10 drawings?

1) Draw the starting number as shown.

2) Draw 4 circles. You can put one ten in each circle. Cross out the 4 tens you have shared. The 12 that is left should be divided between the circles as units







Written Calculation Policy for Division

Step 6 - (Normally Year 3 to Year 4)

Short method for ÷ U with base 10 support (No remainders)

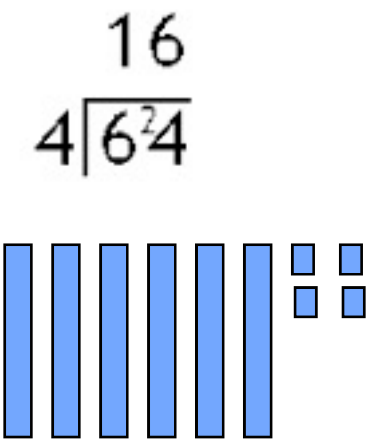
Language is key to ensure children aren't just following a process, but have some understanding about what is happening.

Drawn or actual Base 10 representation of the number will help children to see what is happening.

In this example, 6 **tens** can be shared between 4 so each have 1 ten each (1 written in the tens column above). The remaining 2 whole tens cannot be shared unless they are exchanged for units. Therefore the 2 is inserted before the 4 to make 24 units. This can be shared equally between 4 people with an answer of 6 each (6 is written in the units column above).

The 'sharing' concept is soon replaced by children's use of their times table facts. A Good knowledge of times table facts is essential.

Children may switch to saying 'There's one four in six, remainder 2 tens. Exchange the two tens to make 24 units. 24 divided by 4 =6'.



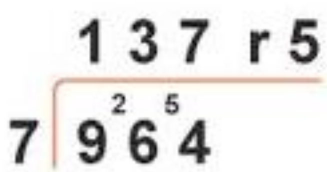
Step 7 - (Normally Year 4 to Year 5)

Short method for ÷ U with remainders

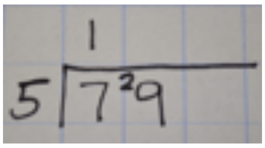
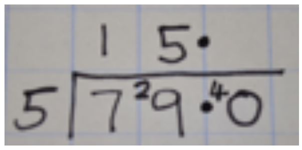
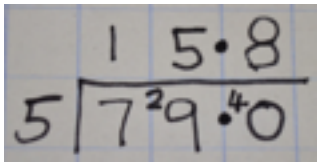
Children simply record remainders at the end of the answer.

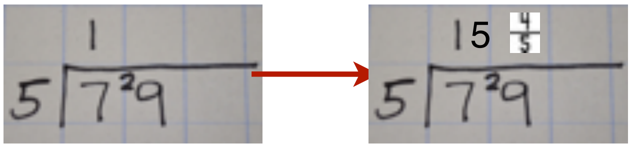
In the context of real problems children should be taught to consider whether their answer needs to be rounded up or not.

E.g. Milly's Farm produces 137 eggs. They are sold stored in boxes with up to 7 eggs in each box. How many boxes will be required?



Written Calculation Policy for Division

Step 8a - Remainders as decimal numbers - Normally Years 5-6	
Step 1 For 79÷5, children follow the process as before . **Step 2** When dividing 29 by 5, making an answer of 5 remainder 4 units, they now exchange the 4 units for 40 tenths. The tenths column must be added to top and bottom,ensuring they line up the decimal point carefully. A zero should be inserted first into the tenths column as the placeholder. **Step 3** Now they can complete the calculation.	1.  2.  3. 

Step 8b - Remainders as fractions - Year 6	
If the question requires the remainder as a fraction, the remainder of 4 at this stage can be written as a fraction of 4/5.	

Written Calculation Policy for Division

Step 9 (Long Division -Chunking) - Normally Years 5-6

E.g. 79 Children should be taught the method of chunking when dividing by two-digit numbers.

E.g. 451÷36.

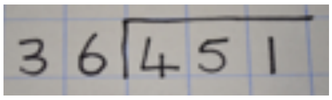
Children are taught to subtract known groups of 36. Jottings at the side of the calculation (multiples of 36) should help children as the calculation progresses.

In this calculation it is sensible to start by subtracting ten lots of 36 (360). Notice the underlining (10 x 36) indicating how many lots of 36 have been subtracted.

91 remains so, checking across to their jottings, children can see how many more lots of 36 they are able to subtract. (In this case 2 more lots).

Altogether 12 lots of 36 have been subtracted with a remainder of 19.

1.



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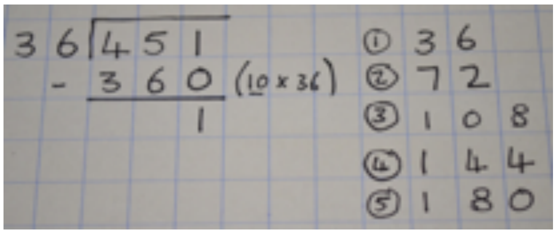

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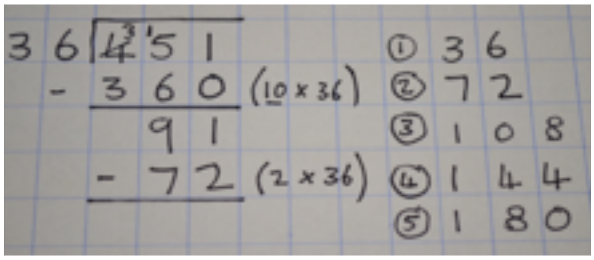

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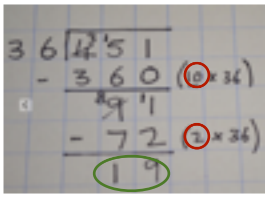

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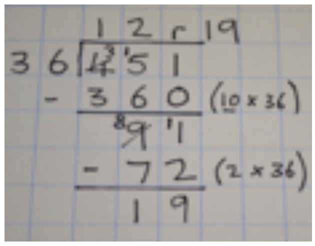

Step 10 - Normally Years 5-6

Short method for ÷ TU

This step requires the children to divide by TU. It requires the same method as step 7 although the children should be encouraged to write the tables of the divisor.

For example:

869÷32

```
   0  2  7  r9
32| 8 ⁸6 ²²9
```

32
64
96
128
160
192
224
256