Calculation Policy

Standard forms of shorthand calculation.

Expanded methods that lead to shorthand forms.

EYFS and KS1

Methods and Examples of Calculation from Nursery to Year 2

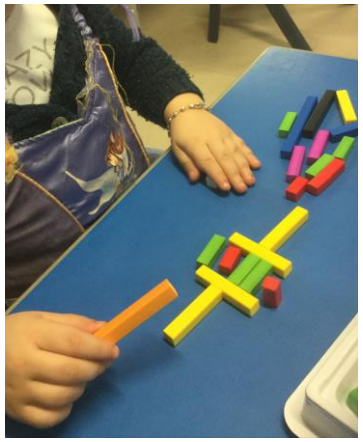
EYFS

- **There is no rush to abstract working.**
- In EYFS and KS1 children will be given a solid understanding of number in practical and concrete work and then moving into some pictorial representations based on concrete apparatus.
- Emphasis is placed on solid understanding of number in real-life context with a range of non-uniform and uniform objects.
- Fundamental counting skills are taught.
- Activities such as counting songs are used to support mathematical development.
- Numicon and Cuisenaire equipment is introduced to the children to encourage exploration of number through practical play activities.

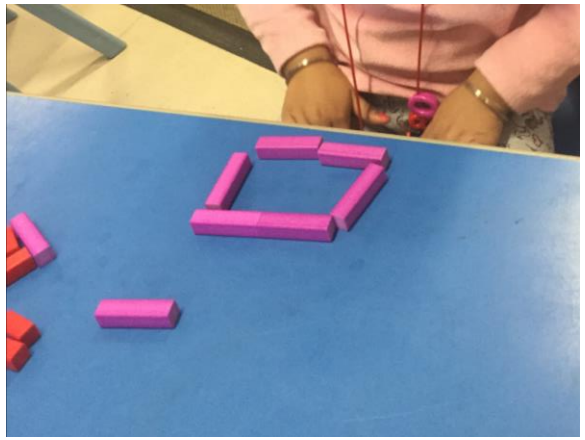
EYFS

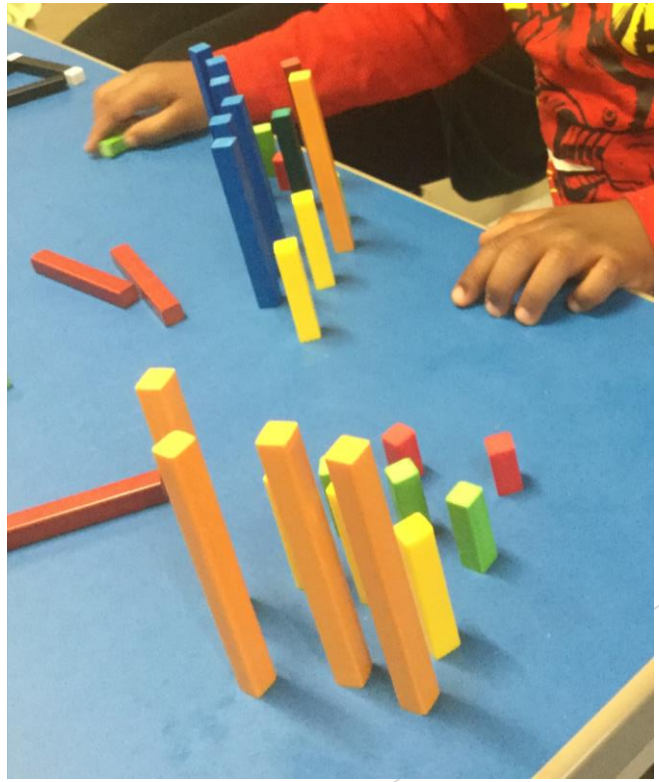
- Problem solving with number is introduced through practical activities and simple bar models are introduced through 1:1 correspondence.
- There is a strong emphasis on using a wide variety of mathematical vocabulary to support the children's development in expressing mathematical ideas.
- Children manipulate objects to solve problems.
- Activities are planned that children encounter number in a wide range of contexts with a wide range of resources.
- The inside and outside areas provide number rich environments and children will experience written numbers and encounter the +, - and = symbols.

Nursery



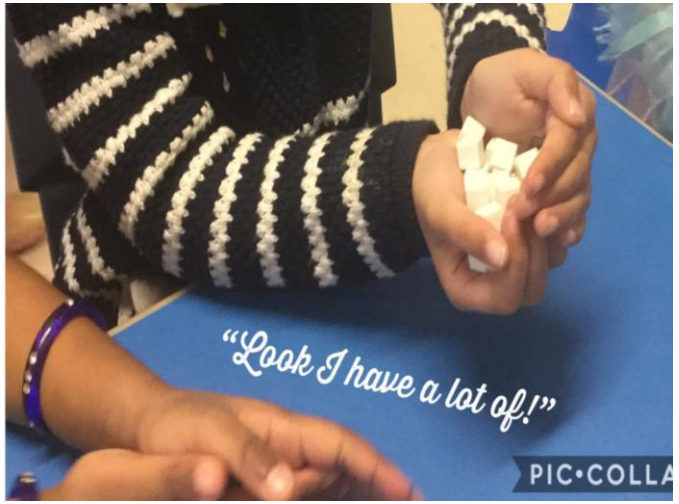
Exploration of Cuisenaire rods. Experimentation of shape and symmetry. Supporting development of pattern recognition and comparative language.





Exploration of comparison of different heights. Practical experience and visual imagery of different heights/amounts. Real-life experience that supports development and understanding of comparative language.

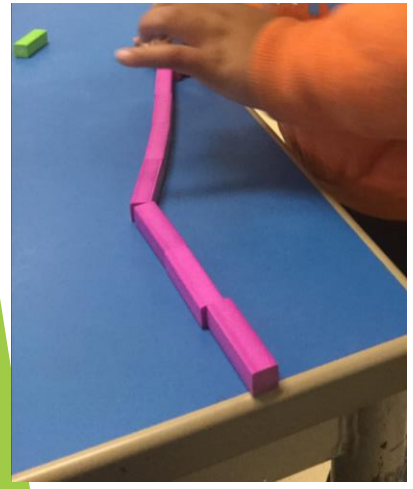
Nursery



Play encouraging use of early mathematical language.



Beginnings of exploring equivalence and non-equivalence in practical situation.



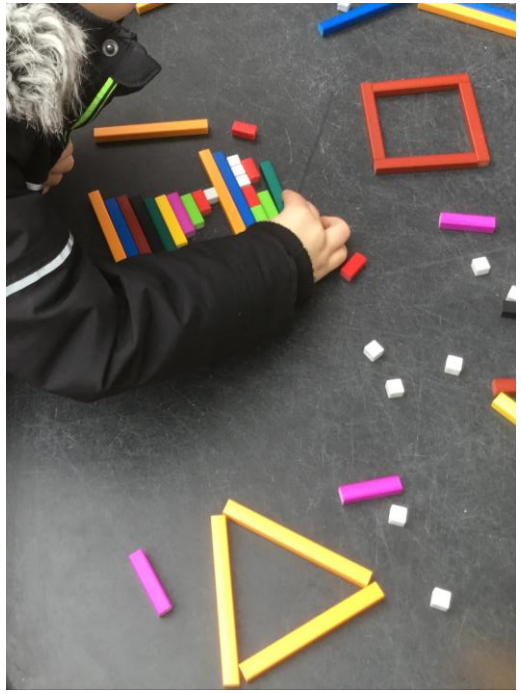


Equipment supporting developmental understanding of conservation of number – same amount although position has changed.

Reception



Free experimentation with Cuisenaire rods leading to practical experience of comparing and ordering amounts. Real-life experience to support the developmental understanding of number and comparative language. Exploration of equivalence and non-equivalence.





Reception



Concrete equipment to support the development of subitising, ordering and comparison.



Reception



Experiences of concrete equipment to solve problems. Use of practical experiences alongside some abstract recording.



Development of understanding of one object being worth more than one. Practical equipment used supporting calculation – strategies of ‘counting all’ and ‘counting on’

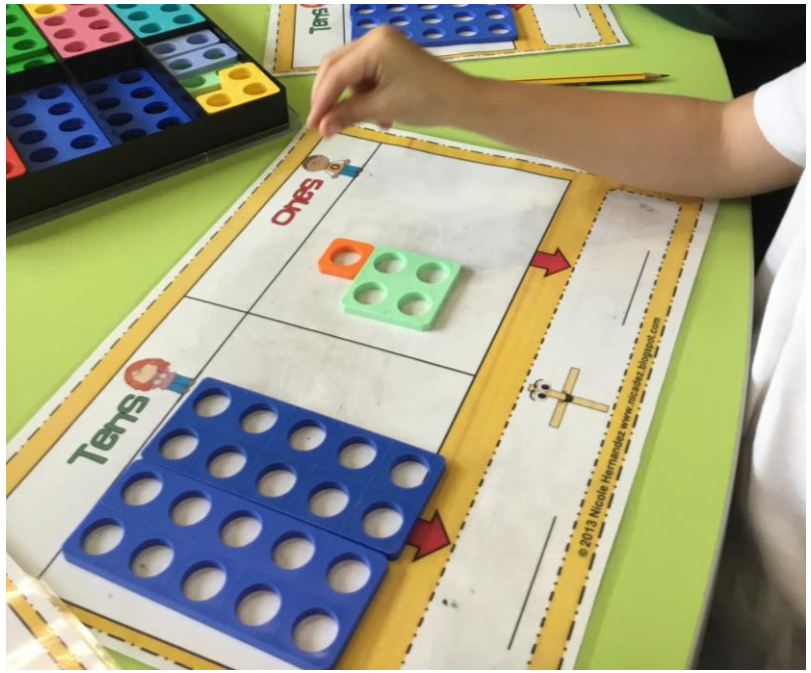
Years 1 and 2

- Solid understanding of number and manipulation of number with practical resources is still emphasised over formal abstract number.
- Good number practise from EYFS continues into Year 1 – continuing with a wide range practical activities, carefully planned opportunities to learn through play, ass well as direct teaching.
- Later on in the year in Year 1 and moving into Year 2 children will begin to equate their concrete understanding into pictorial and then abstract understanding.
- The children continue to use a wide range of equipment – uniform and non-uniform objects.
- Numicon and Cuisenaire rods are revisited and used often to help the children record their ideas practically and then pictorially.
- Base ten apparatus is introduced and place value is strongly emphasised in Year 2. Again using practically to support the children to develop informal pictorial jottings.

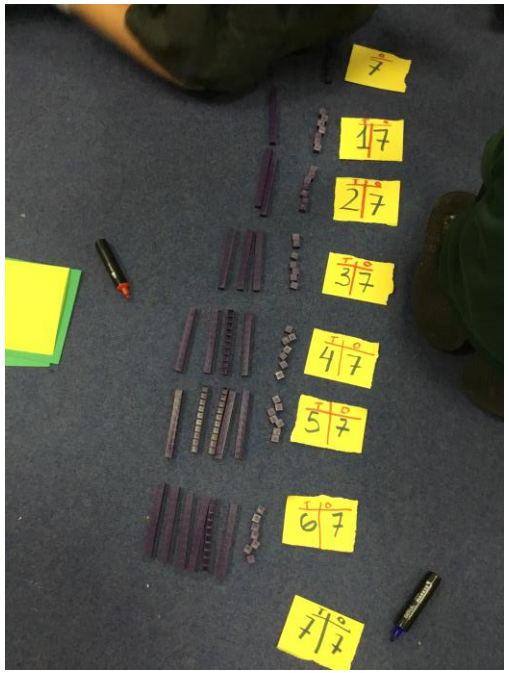
Years 1 and 2

- Vocabulary for addition and subtraction continue to be modelled and taught.
- Number lines are modelled and taught and the children encouraged to use these to record their working.
- Children are shown how to relate written abstract calculations alongside their practical and pictorial work.
- Bar modelling is taught throughout all areas and is shown as a method recording to support reasoning and calculation. This will still continue to be 1:1 correspondence.

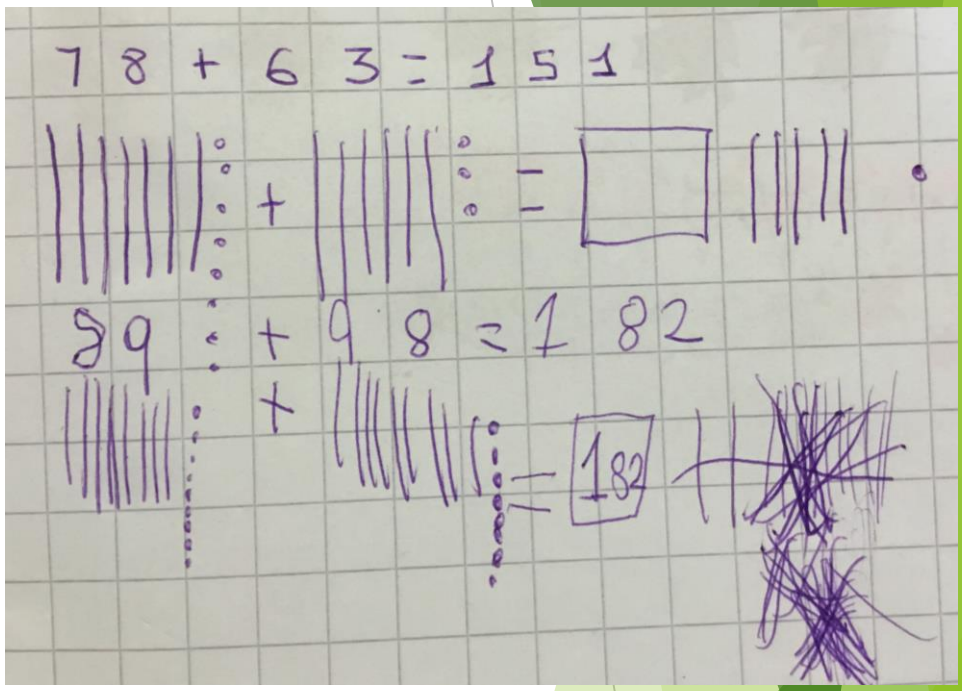
Year 2



Numicon.
Development of place value understanding with equipment and place value mats.

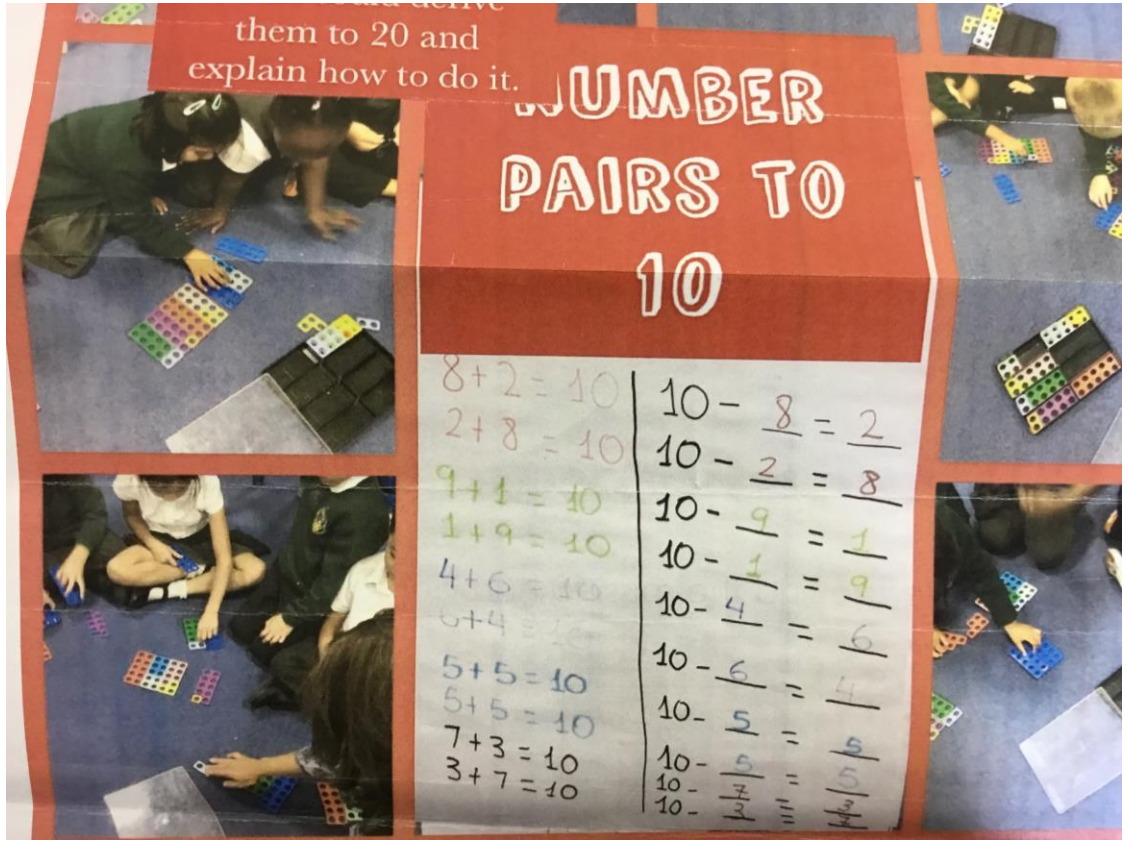


Adding and subtracting groups of ten.



Informal jottings of alongside base ten apparatus.

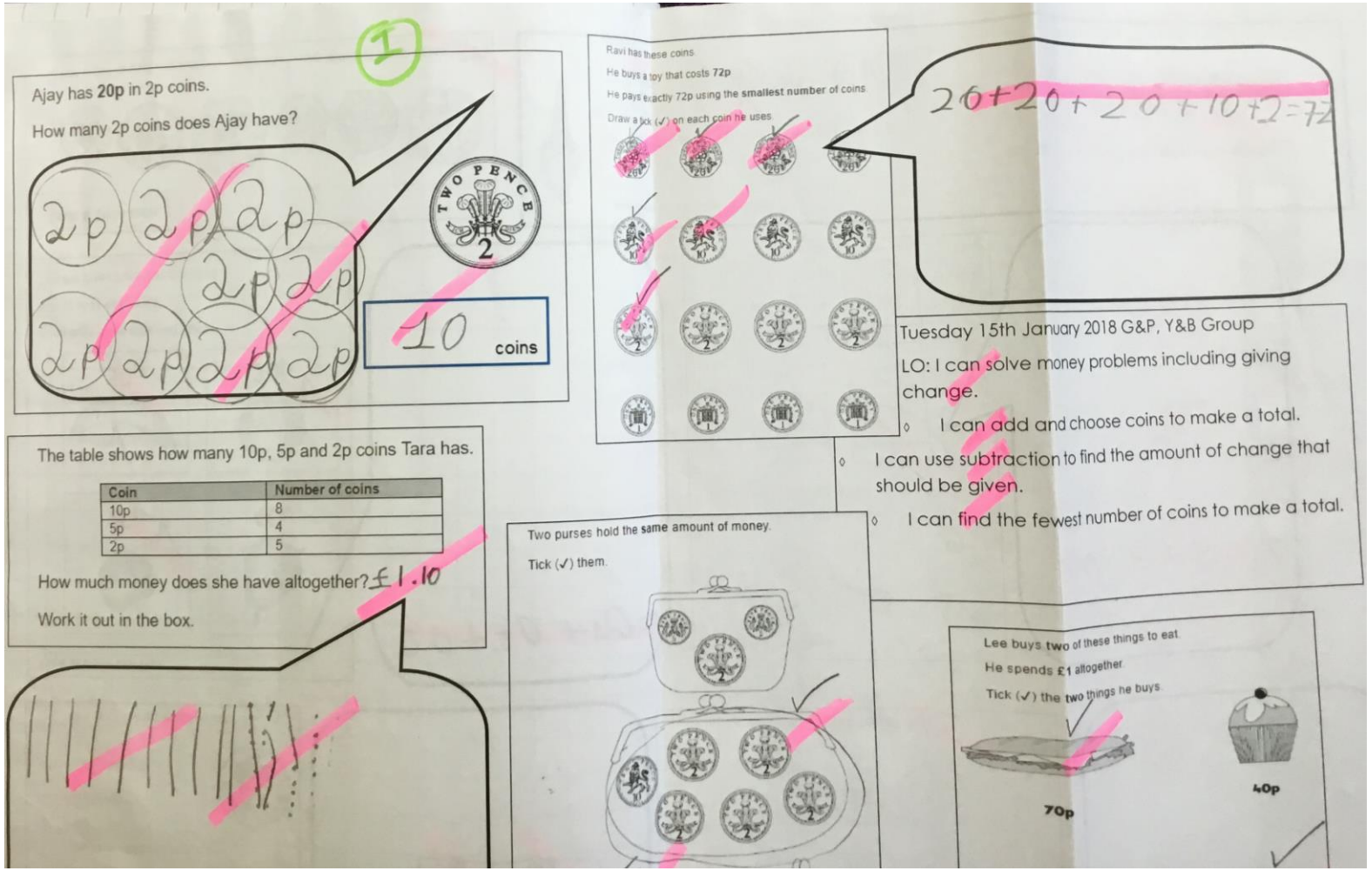
Year 2





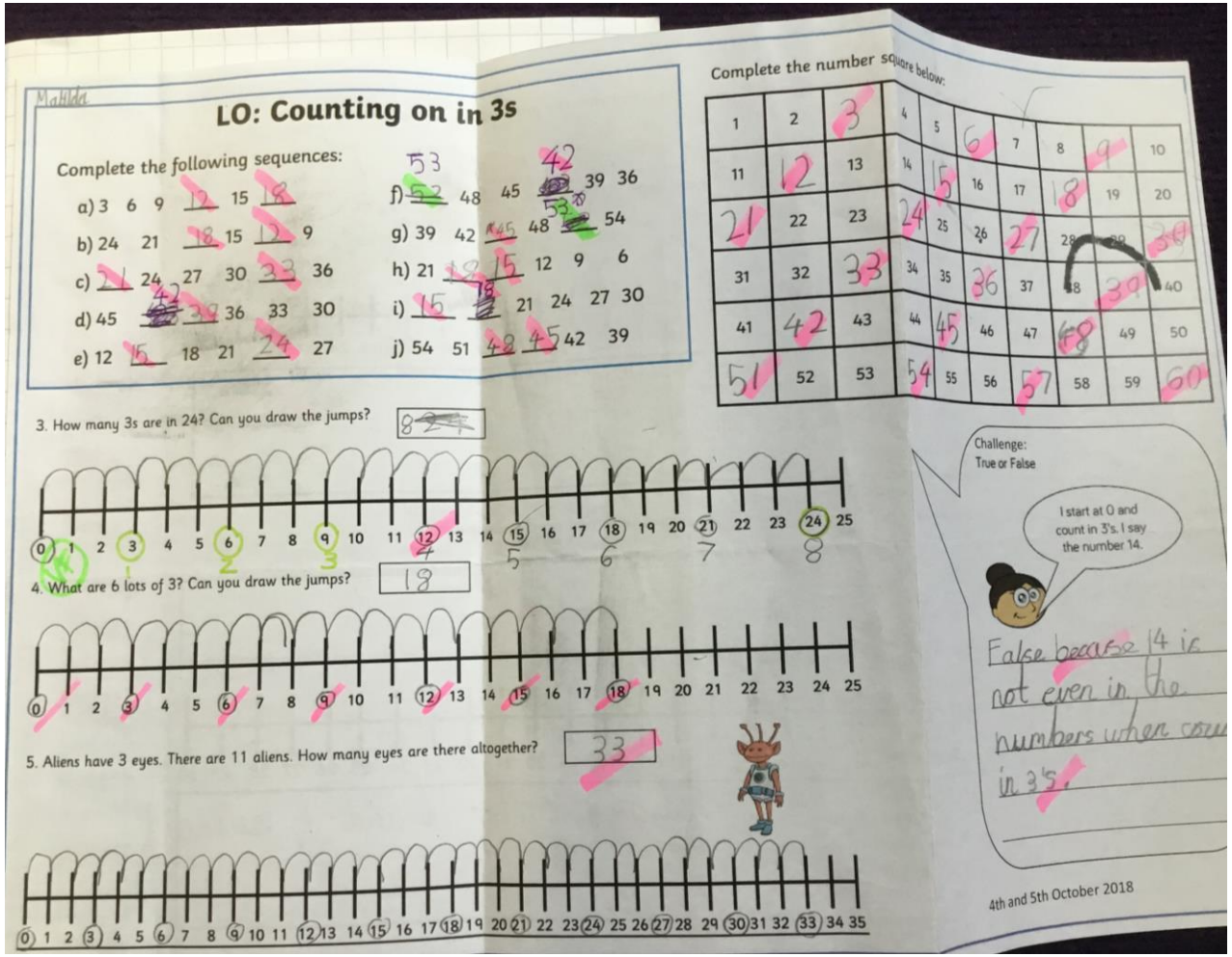
Use of practical equipment alongside pictorial and abstract recording for addition and subtraction.

Year 2



Practical equipment leading into informal pictorial jottings and then abstract recording.

Year 2



Matilda

LO: Counting on in 3s

Complete the following sequences:

a) 3 6 9 12 15 18

b) 24 21 18 15 12 9

c) 21 24 27 30 33 36

d) 45 42 39 36 33 30

e) 12 15 18 21 24 27

f) 53 48 45 42 39 36

g) 39 42 45 48 53 54

h) 21 18 15 12 9 6

i) 15 18 21 24 27 30

j) 54 51 48 45 42 39

Complete the number square below:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60

3. How many 3s are in 24? Can you draw the jumps? 8

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

1 2 3 4 5 6 7 8

4. What are 6 lots of 3? Can you draw the jumps? 18

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

5. Aliens have 3 eyes. There are 11 aliens. How many eyes are there altogether? 33

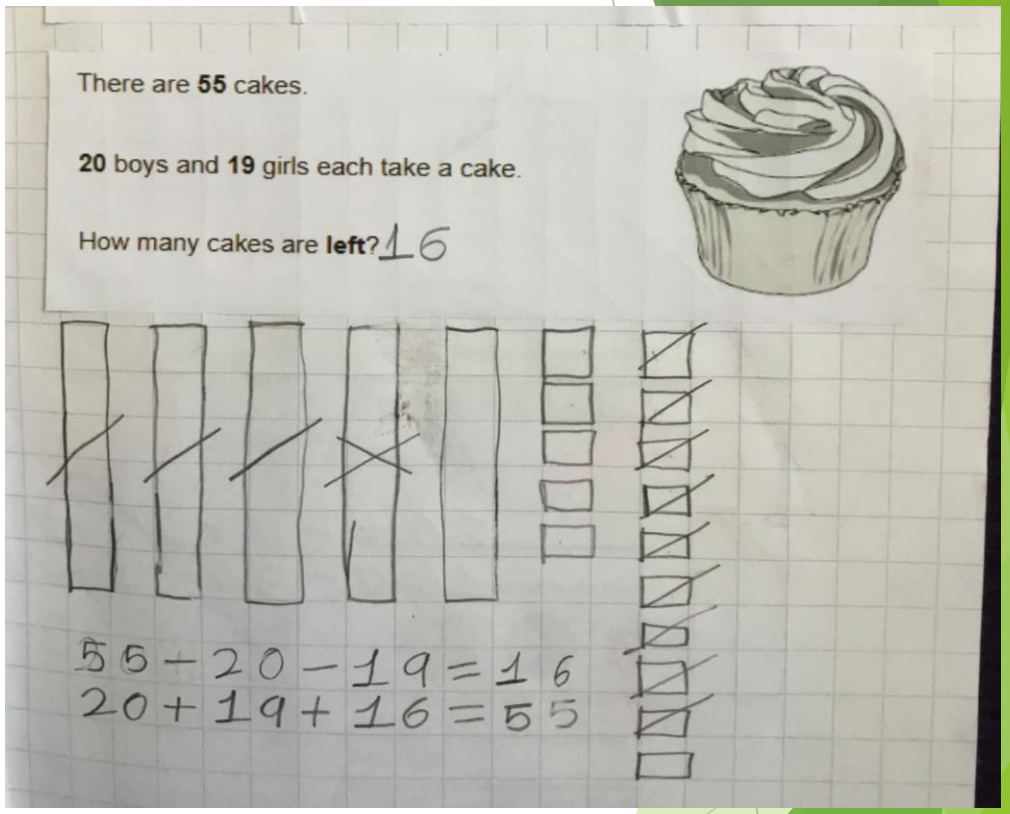
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

Challenge:
True or False

I start at 0 and count in 3's. I say the number 14.

False because 14 is not even in the numbers when counting in 3's.

4th and 5th October 2018



There are **55** cakes.

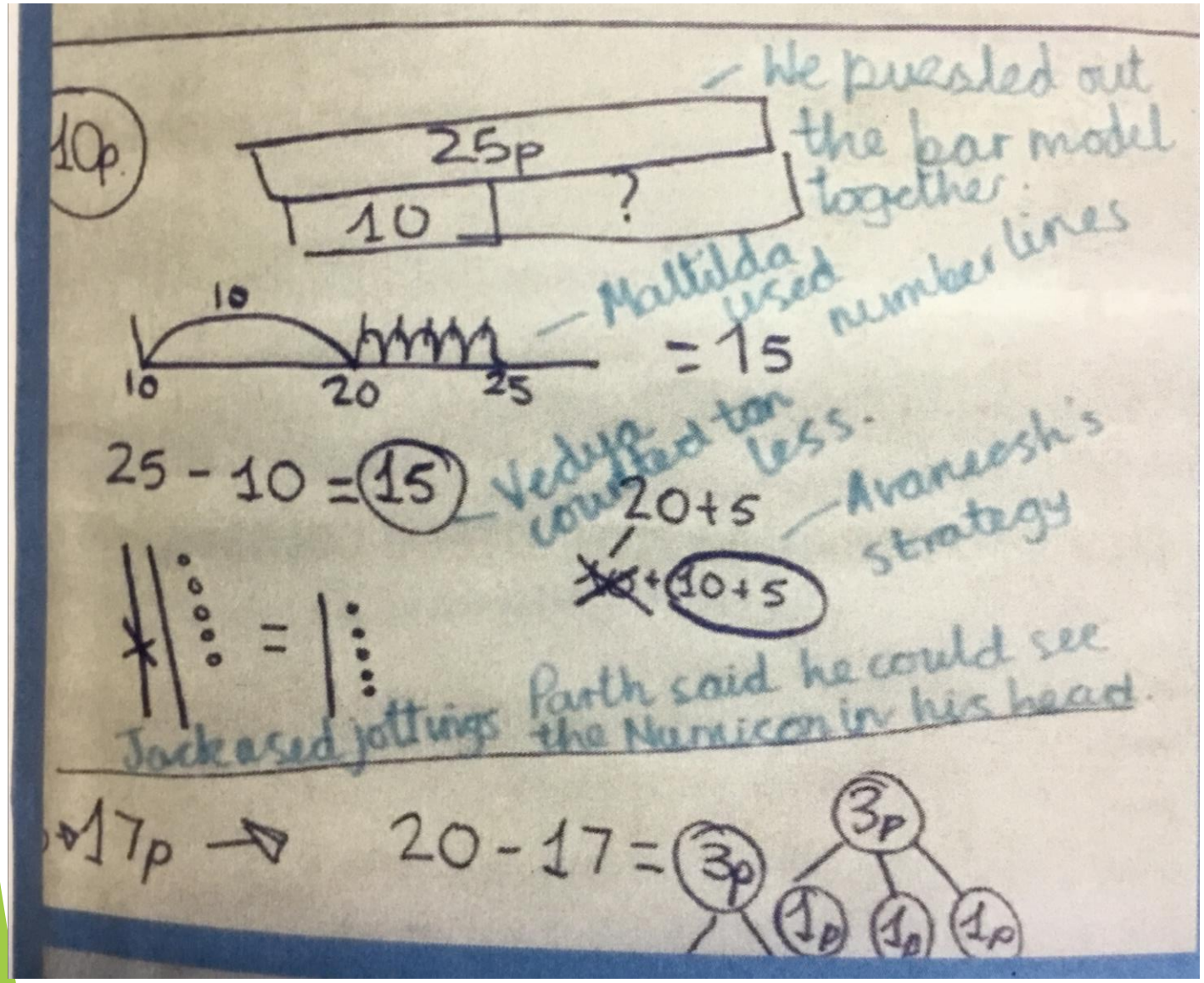
20 boys and **19** girls each take a cake.

How many cakes are **left**? 16

55 − 20 − 19 = 16

20 + 19 + 16 = 55

Year 2



Different methods of recording to show varied fluency.

Modelled jottings for children to use.

KS2

Methods and examples of Calculation from Years 3 to 6

Year 3

- Good practice from Year 2 using practical equipment and informal jottings are still taught and linked to abstract recording.
- Numicon, Cuisenaire and Base ten apparatus are often used to support children in their working.
- Bar modelling is taught throughout and for all four operations to support reasoning and calculation.
- Formal shorthand methods are introduced using Base ten equipment and other apparatus to support understanding of methods.
- Expanded methods may be taught to lead into short-hand methods later.
- Methods such as number lines are still taught and encouraged.

Year 4

- Formal shorthand methods for all four operations are revisited and taught.
- Practical equipment is still used to teach formal methods alongside the abstract working to support their understanding of how methods work.
- Expanded methods are taught and encouraged for those children who need this support to develop and strengthen their understanding.
- Jottings and informal working are encouraged but methods are explored as to whether they are practical to the numbers involved.
- Bar modelling is further developed and taught in all areas of maths including fractions and decimals.

Years 5 and 6

- Addition, subtraction and multiplication are revisited and shorthand methods emphasised.
- Expanded methods may still be encouraged for children who need to consolidate their understanding.
- Division is emphasised and practised as this is often the last taught operation and needs time to be embedded.
- Bar modelling is still modelled and taught in all areas of the curriculum.
- Moving from Year 5 and into Year 6 children are taught and supported to use the most efficient methods to solve calculation.

KS2 Introduction of Formal Column Methods

- For all written column methods the operation symbol is to be written on the left.
- For addition, subtraction and multiplication refer to 'start on the right', 'start with the smallest column' so that misconceptions are avoided. 'Start with the units' is inaccurate as the children are then introduced to decimal numbers.
- For all operations teach children to insert the decimal point in the correct place before working numbers so that it is not forgotten or misplaced.

Formal Compact Addition

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

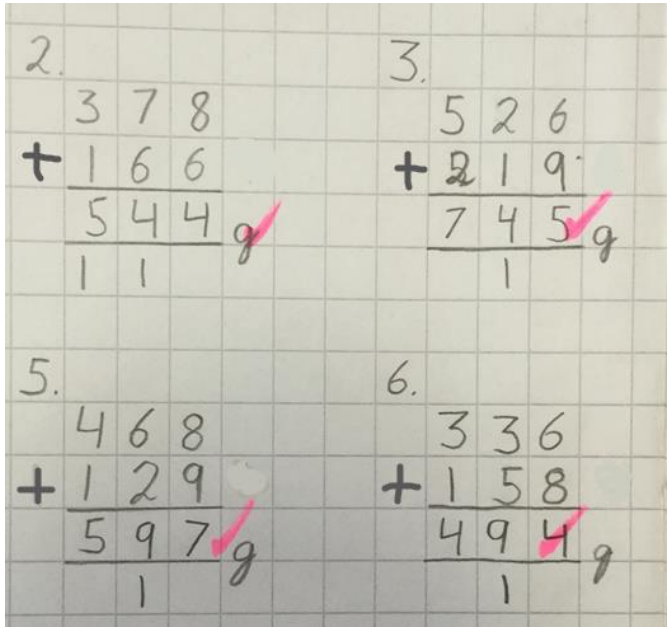
- Operation symbol to be written on the left.
- All notation is written across the bottom.
- Exchange into new columns to be referred to as ‘carrying’.

Formal Compact Addition with Decimals

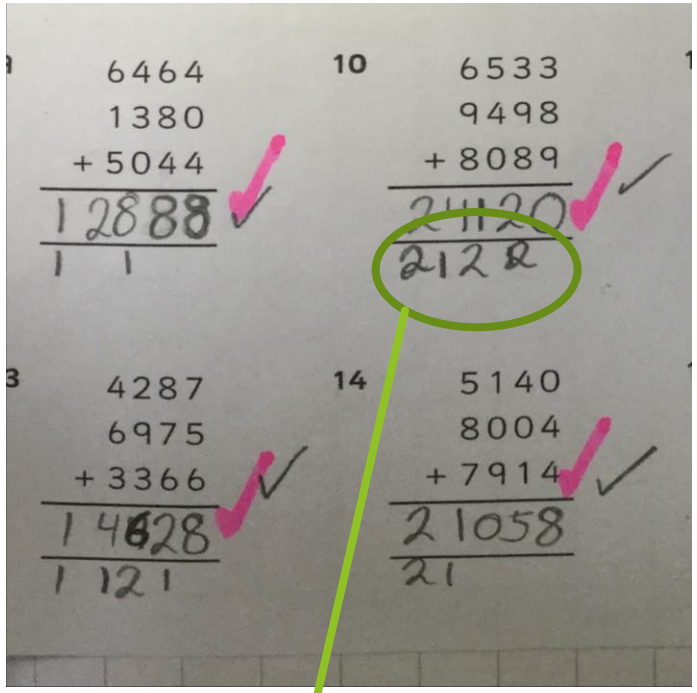
	5	6	7	.	0	5
	4	9	6	.	1	2
+		8	4	.	2	3
	9	5	7	.	4	0
	2	1			1	

- Same terms etc as above.
- Teach pupils to insert decimal point before working numbers to avoid decimal points being misplaced or forgotten.

Column Addition



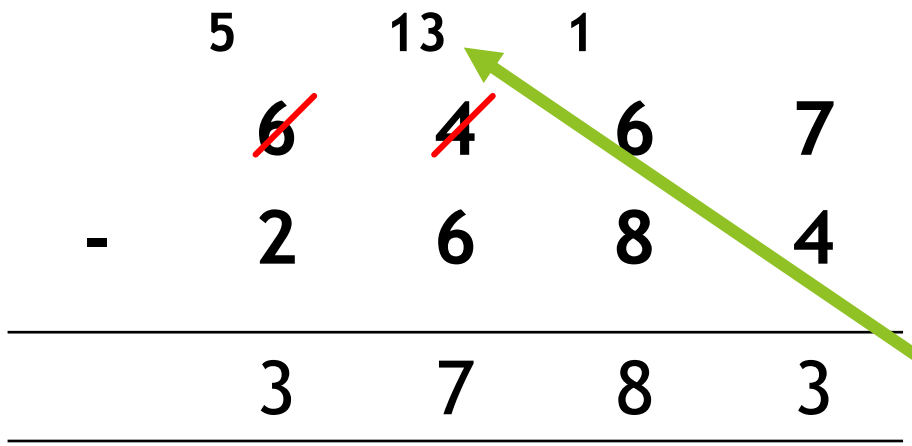
Correctly aligned columns
All notation at the bottom.



Adding more than 2 numbers so that children understand that more than one ten may be carried to the next column.

This later links to multiplication were it is often the case that more than one ten is carried.

Formal Compact Column Subtraction



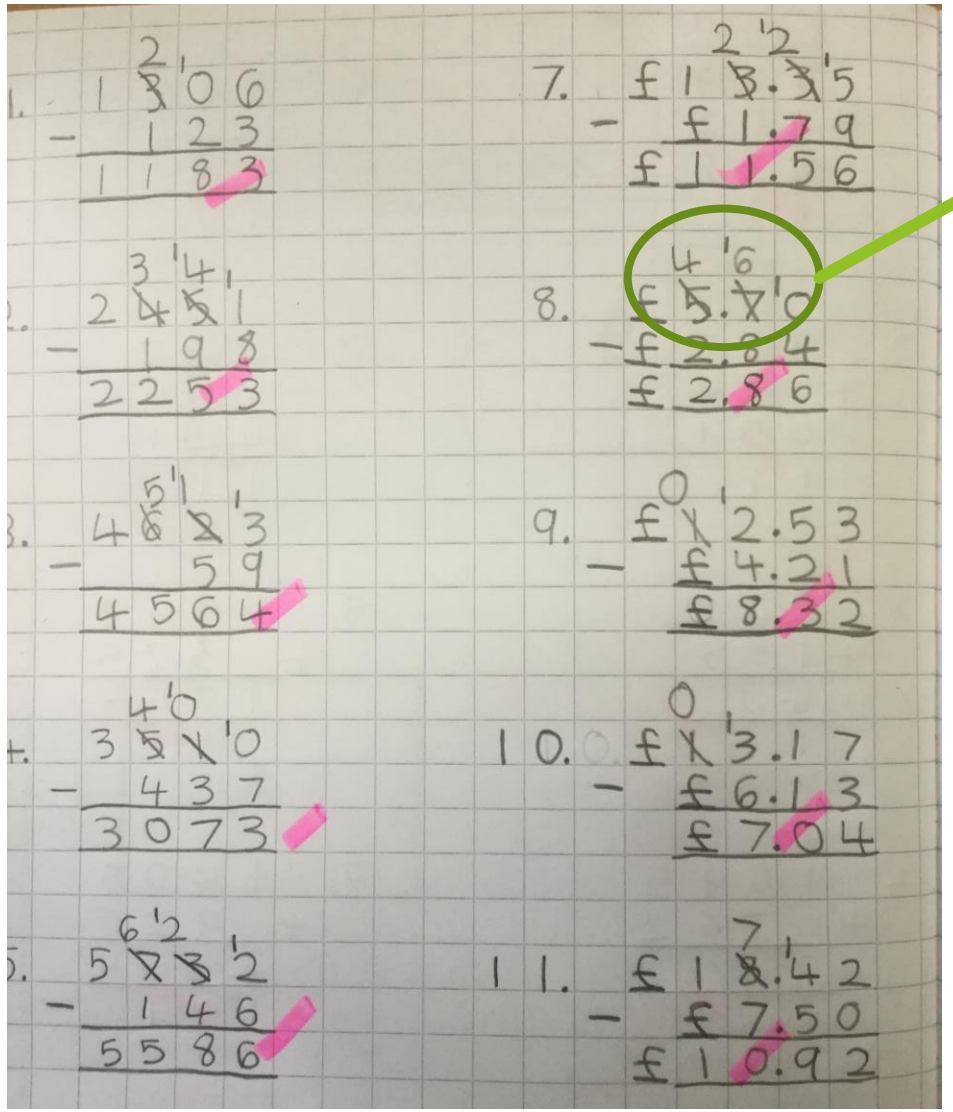
- Operation symbol to be written on the left.
- All notation to be written across the top.
- Ensure notation is written to the left.
- Exchange into new columns to be referred to as ‘exchanging’. Do not use the term ‘borrow’.

Formal Compact Column Subtraction with Decimals

	5	13	1			
	~~6~~	~~4~~	6	7	.	6
-	2	6	8	4	.	2
	3	7	8	3	.	4

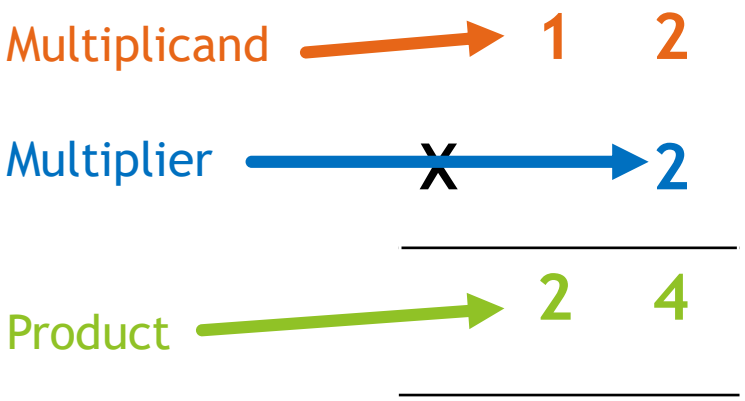
- Same terms etc as above.
- Teach pupils to insert decimal point before working numbers to avoid decimal points being misplaced or forgotten.

Column Subtraction



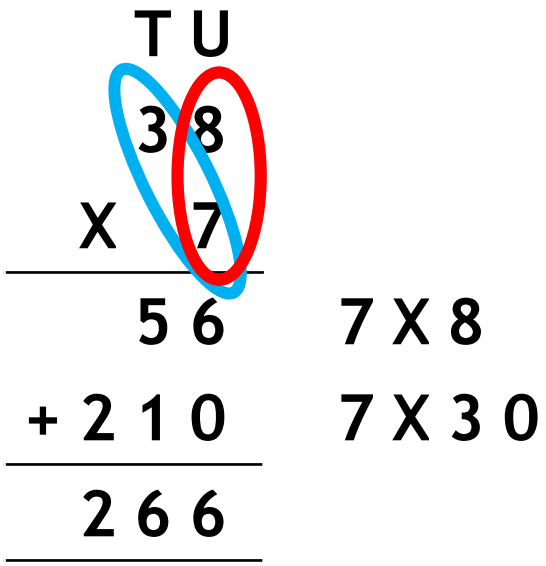
Correctly aligned columns
Symbol on the left
Placement of decimal point
All notation across the top of the calculation

Formal Compact Column Multiplication



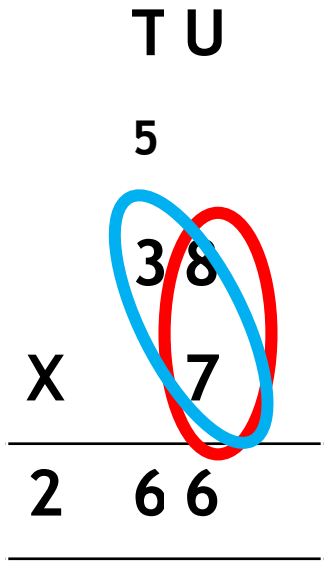
- Introduce and use these terms from Year 3.
- These terms are present in Upper KS2 and used in questions in SATs papers.

Formal Shorthand Column Multiplication



7 X 8

7 X 3 0

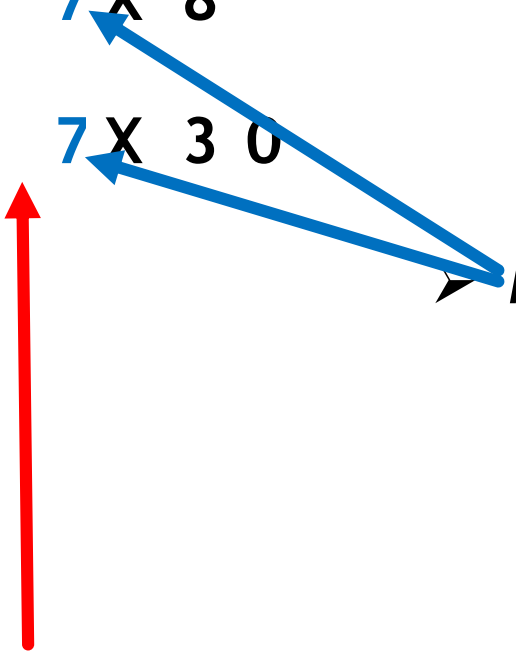


- For either of these methods labelling columns and circling are appropriate strategies to support children's thinking in these processes.
- You may wish to colour code this on the board when modelling.
- Children can simply loop a column at a time with their pencil.

Formal Compact Column Multiplication – Expanded Method.

- Introduce column multiplication with the expanded method first.

```
   3 8
 X   7
-------
   5 6    7 X 8
+ 2 1 0    7 X 3 0
-------
   2 6 6
-------
```



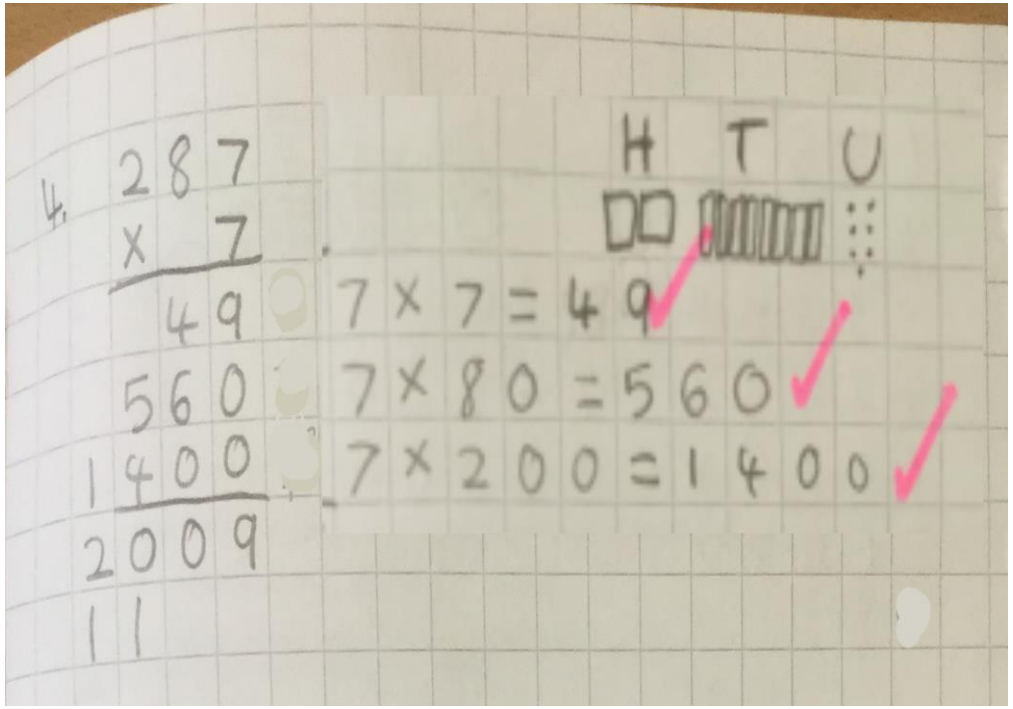
- Multiplier to be written first.
- Leave a space between working and written calculation.

Formal Shorthand Column Multiplication

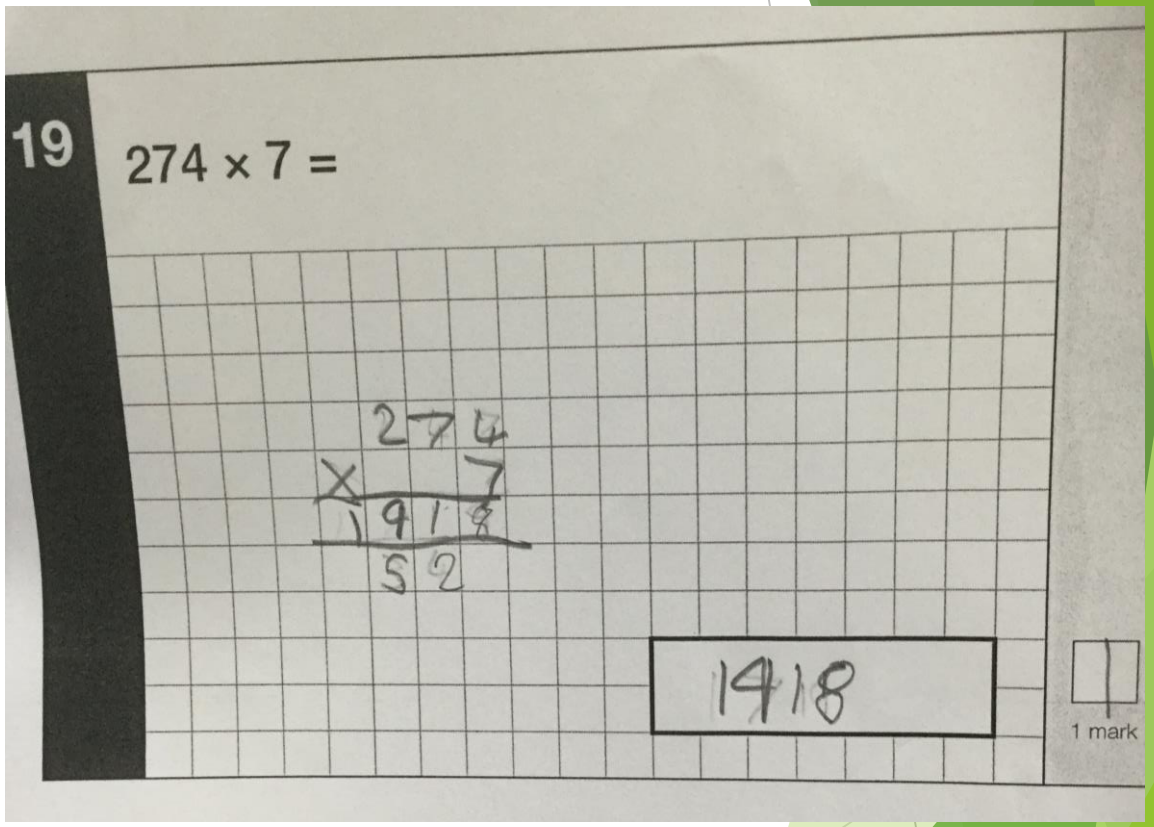
	3	8
X		7
2	6	6
2	5	

- Operation symbol to be written on the left.
- Refer to exchanging columns as ‘carrying’.
- All notation to be written underneath.

Column Multiplication



Expanded method multiplication
Correctly aligned columns
Partitioned working with smallest column.
Multiplier written first.
Informal jotting to support thinking.
Addition carried out with notation underneath.

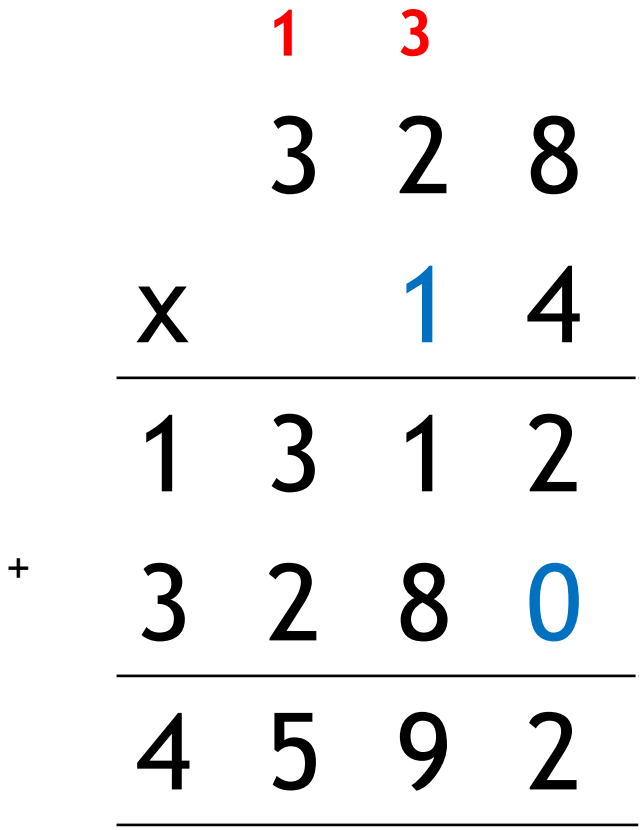


Formal shorthand method.
Correctly aligned columns.
Symbol on the left.
All notation underneath.

Formal Shorthand Column Multiplication for ‘Long Multiplication’

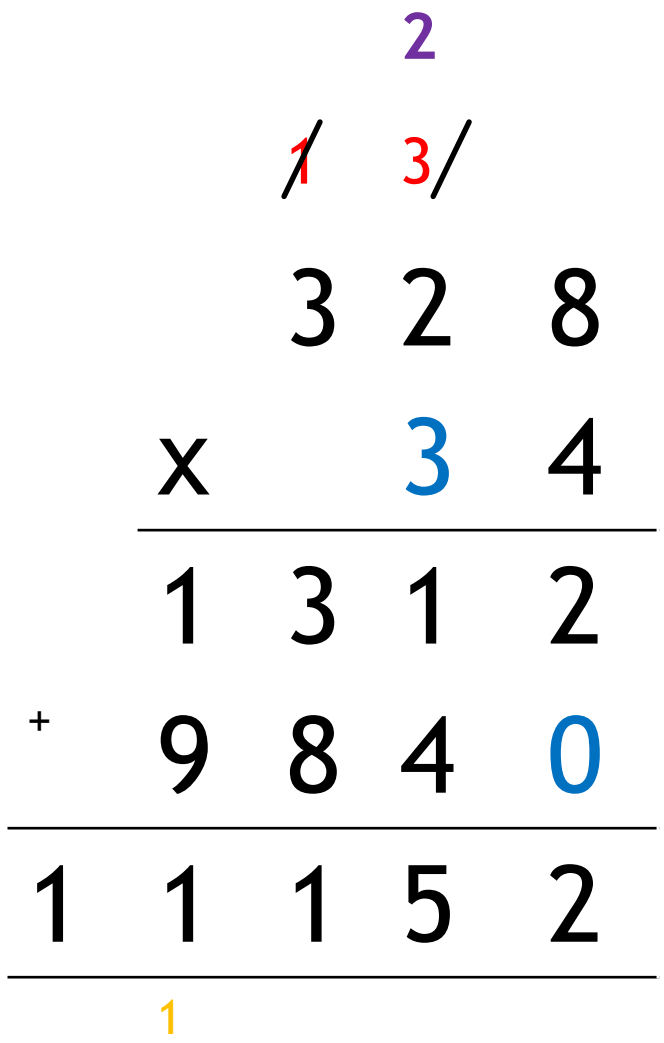
The expanded method is inappropriate for multiplying with 2 digit numbers or larger – overly complicated and long winded – pupils need to use a compact method.

Formal Shorthand Column Multiplication for ‘Long Multiplication’



- Notation to be written at the top.
- Refer to exchanges into new columns as ‘carrying’.
- Second row – add place holder to show increase by ten times the amount.
- Work a column over to the left.

Formal Shorthand Column Multiplication for ‘Long Multiplication’



- Long multiplication will have two sets of notation at the top.
- Record notation as in short multiplication – once the first row is completed cross out the notation.
- Second row – add place holder to show increase by ten times the amount.
- Work a column over to the left.
- Now complete the second row with a new row of notation above the previous.
- Addition completed with notation underneath.

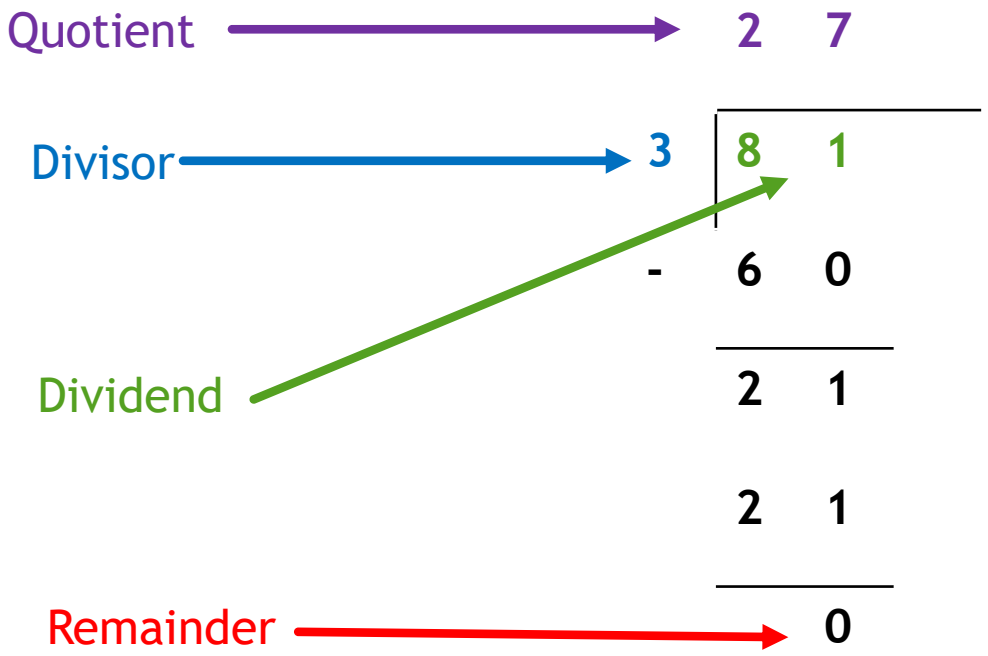
Multiplying with a Decimal in Columns.

- Calculation layout is tricky for multiplying with a decimal. For example in this question the 4 should be placed under the 6 according to place value columns.

```
   6 . 5
x      4
---------
2 6 . 0
---------
   2
```

- It is quicker and easier to record the whole number on the right (in the wrong column.) Speak to the children about this – if they have reached the point of this learning they should be able to understand and cope with the misplacement.
- Put in the decimal point first – emphasise this. It will prevent mistakes in place value in the answer.
- Now work as short-hand multiplication.

Formal Shorthand Division

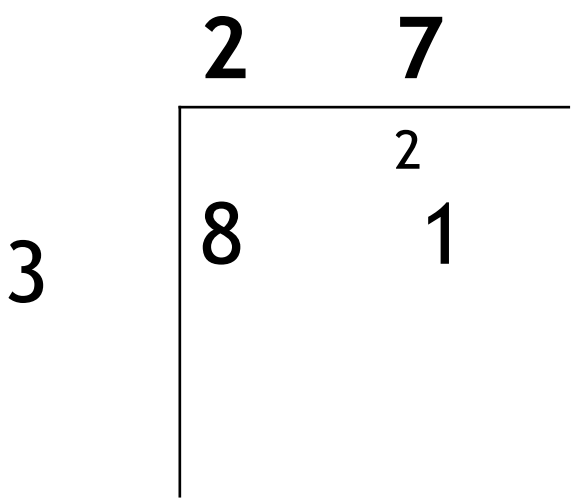


These are the correct terms for the parts of division calculations. The children need to be taught these from Year 3 with focus on learning

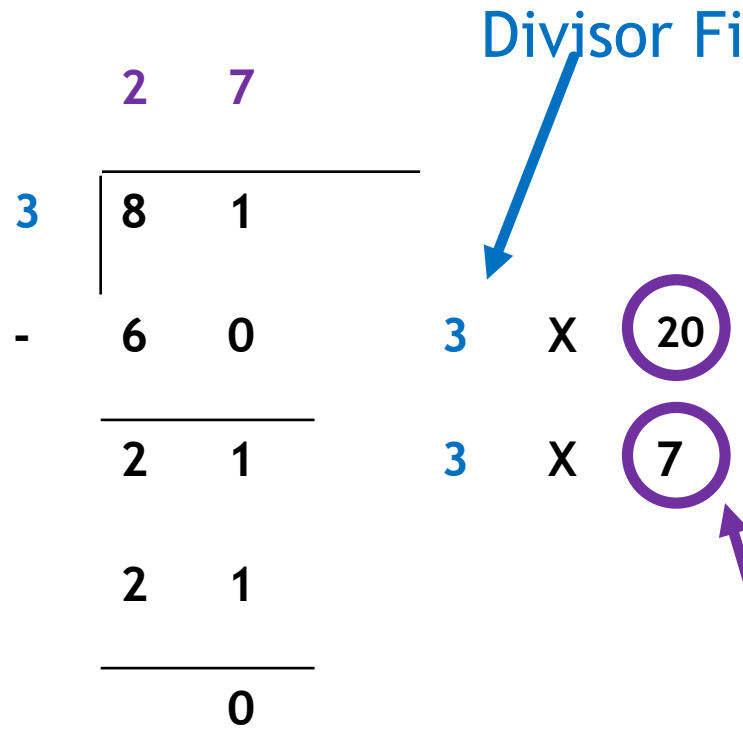
Quotient
Divisor
Remainder

These routinely come up in KS2 SATs questions.

Formal Column Compact Division



Short hand ‘bus stop’ method.
This can be taught in a more expanded way to support thinking and moving into long division.



Divisor First

3 X 20

3 X 7

Circle or underline quotients.
Recombine to give final answer.

Column Compact Division

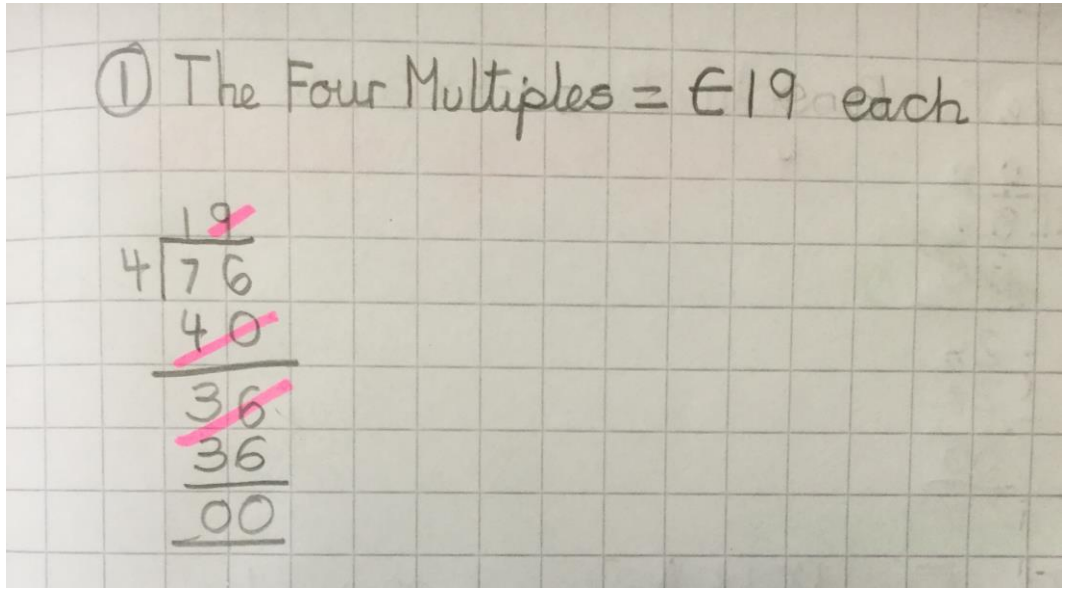
	T	U
	2	7
3	8	1
	6	0
	2	1
	2	1
		0

3 goes into 8 twice.
Place value means 3 x20 =60
Subtract 60
3 goes into 21- 7 times.

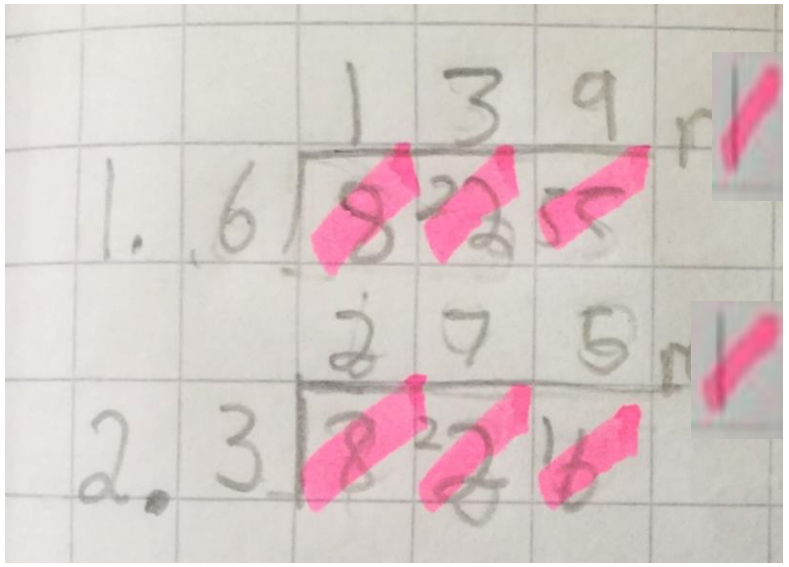
		2	7
3	8	1	
	6	↓	
	2	1	
	2	1	
		0	

From this into moving this method to arrows and not 0s

Column Division



Short division solved with long division method.
Working underneath.
Down to 0 to show no remainder.



Formal shorthand ‘bus stop’
All notation through columns working from left to right.
Remainder written as ‘r’.

Working to Support Long Division

Use the counting stick method to record the working that the children need before starting the process of a calculation. Using this method means they can work with any times table and that once this working out is complete their working memory is clear in order to focus on the steps in the division calculation, not needing to jump back and forth.

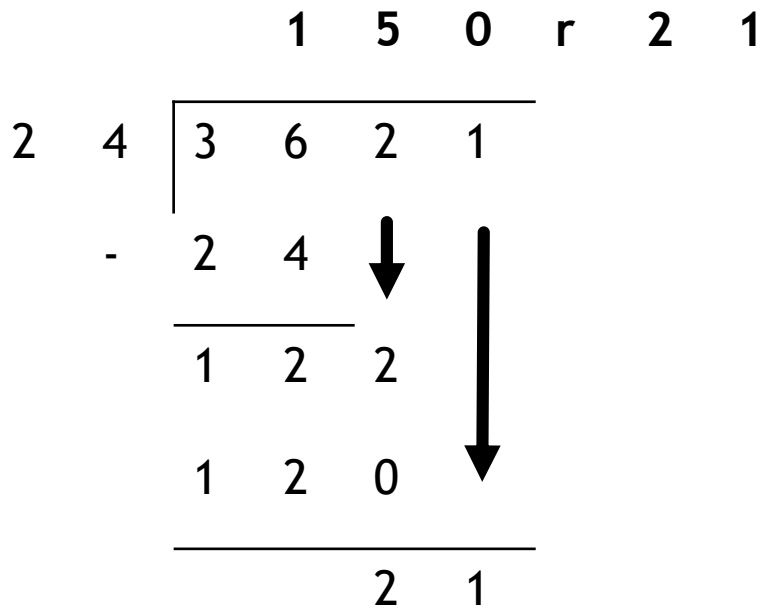
2 4 | 3 6 2 1

The children need their 24 times tables!

1. Write numbers 1 to 10 in a list.
2. Fill in the calculations using the ‘counting stick’ method used to teach time tables in class.
3. Work out…

1x – one lot
10x – 10 tens (knowledge of place value)
5x – half of 10 lots
2x – double 1 lot
4x – double 2 lots
8x – double 4 lots
3x – add 1 lot and 2 lots
6x – double 3 lots
9x – add 3 lots and 6 lots, triple 3 lots or add 8 lots and 1 lot
7x – add 6 lots and 1 lot.

Long Compact Division



24x1=24

Bring down the 2 to make 122

24x5=120

Bring down the 1 to make 21

24x0=0

Record the remainder at the top on the right

Times tables facts recorded before starting to support working.

1x24 = 24
2x24 = 48
3x24=72
4x24=96
5x24=120
6x24=144
7x24=168
8x24=192
9x24=216
10x24=240

Supporting Long Division

- Children write times table facts related to the question at the side before working.

- Use place value equipment to support understanding of how the shorthand method works.

Using Base Ten Equipment