Cheddington Combined School

Progression in Calculations
Key Stage 2

Parental Guidance Booklet

CONTENTS

INTRODUCTION

This booklet aims to explain how we, at Cheddington Combined School, teach your child different methods of calculation as they progress throughout the school. There are two booklets – one for Key Stage One and one for Key stage two. The methods talked about in each booklet include not only written calculations but also mental methods of calculating.

The methods may look different to what you are familiar with but they may be how your child will be learning to calculate at school. Hopefully, the explanations of the different methods will help you to understand how certain aspects of numeracy are approached in teaching today and enable you to help your child as much as possible. Obviously, this is written as guidance for you, but if you are confused about anything your child is learning in their class you should approach the teacher or numeracy
co-ordinator.

There is a strong emphasis on mental calculation strategies from foundation stage and it is not until your child progresses through Key Stage 2 that more formal methods of written calculations are introduced. Your child will be building on the experience that they learn year by year and by the end of Key Stage 2 when they move onto secondary education they will be well equipped to deal with numeracy at a higher level.

In general all calculations are written horizontally at first, until children decide which way to work them out

e.g.

45 + 13 = NOT vertically

```
 45
+13
```

Children are becoming more familiar with the words associated with the different number operations (addition, subtraction, division, multiplication) and this is something that we encourage you to continue with at home. This greatly helps children in being able to decipher word

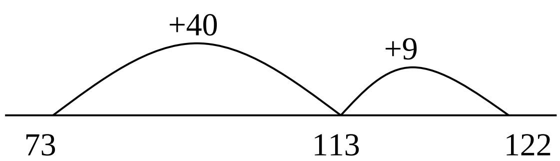
problems and using and applying maths, an area in which there is a large emphasis now.
As your child progresses through Key Stage 1 and Key Stage 2 they will be taught different methods of addition, subtraction, multiplication and subtraction. Some methods they will like and understand straight away and others they may struggle with. Each method builds on another, but it is important to remember that they do not need to be an expert in every method. The aim is for children to find the easiest, quickest and most efficient way for them to work out an answer. This may not be the method you were taught!

ADDITION

Year 3

Your child will continue to work on mental strategies of calculation and become more confident in adding mentally combinations of one or two digit numbers. They will also develop and use more written methods to record, support and explain the addition of two and three digit numbers. The number line will continue to be used as in Year 2, but the sort of jumps used becomes more efficient.

73 + 49 =



- Draw an empty number line and write 73 in correct place
- Think about partitioning the 49 and add as shown

Methods of partitioning are also continued.

73 + 49 = 70 + 40 + 9 + 3
= 110 + 12
= 122

- Partition both numbers
- Add the tens
- Add the units
- Re-combine to make answer

During Year 3 your child will move on to working out addition questions and laying them out in a more vertical style, but still concentrating on partitioning. The method below is called decomposition

Step 1

73 + 49 =		70	+	3
	+	40	+	9
		110	+	12 = 122

Step 3

Step 2

- Step 1 - Partition both numbers but write them out vertically making sure that the tens are underneath each other and the units are underneath each other
- Step 2 – Looking vertically add the tens and then add the units
- Step 3 – Recombine to make the answer

Year 4

In Year 4 your child will still use the number line to work out addition as in Year 3 and previous years, but will continue with more emphasis on the decomposition method.

Step 1

$$\begin{array}{rrrrr} 73 + 49 = & & 70 & + & 3 \\ & + & 40 & + & 9 \\ \hline & & 110 & + & 12 \quad = \quad 122 \end{array}$$

Step 3

Step 2

- Step 1 - Partition both numbers but write them out vertically making sure that the tens are underneath each other and the units are underneath each other
- Step 2 – Looking vertically add the tens and then add the units
- Step 3 – Recombine to make the answer

During Year 4 your child will also look at other vertical layout methods leading up to the compact method (which you may be more familiar with). Example 1 shows the step from the decomposition method and Example 2 shows the follow on to the compact layout. With all these methods it is vital that your child lays out their work using the squares in the book and underneath each other in order to avoid mistakes in future.

Example 1

The same method can be used to add the smallest part of the number first and the largest part of the number last.

$$\begin{array}{rrr} & 4 & 5 \\ + & 1 & 3 \\ \hline & & 8 \\ & 5 & 0 \\ \hline & 5 & 8 \end{array}$$

- Step 1 - add the ones (or units) first
- Step 2 - add the tens by saying forty add ten is fifty
- Step 3 – total the numbers

Example 2

	7	3
+	3	9
		2
	1	

- Step 1 - add the ones (or units) first

  three add nine is twelve

  one ten under the tens column and 2 in the ones (units) column

	7	3
+	3	9
1	1	2
	1	

- Step 2 - add the tens

  seventy and thirty is one hundred, plus ten underneath makes one hundred and ten

  put the ten in the tens column and the 1 hundred in the hundreds column

Year 5 & 6

The methods used in Year 4 are consolidated in Year 5 & 6 are extended to decimals, larger numbers and more than 2 numbers added together.

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

The number line will still be used when appropriate – the compact method is not necessarily the best method for every child.

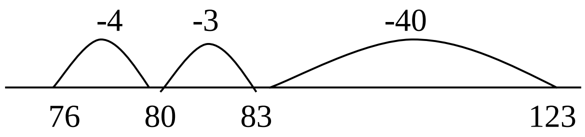
SUBTRACTION

Year 3

Your child will continue to work out subtraction using a number line as in Year 2 but using more refined jumps.

Example A

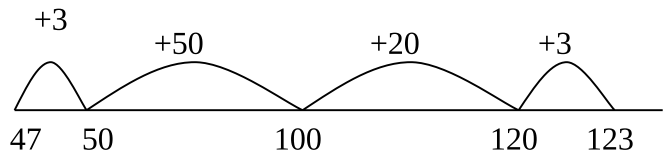
123 – 47 = 76



- Draw the blank numberline and then place 123 123 in the correct place
- Think about easy jumps and partitioning 47. Jump back 40 to 83 and then back 3 to 80, then the remaining 4 to 76.

Example B – counting up

123 – 47 = 76 (interpreted as find the difference)



- Draw the blank numberline and then place 47 and 123in the correct place
- Then work from the 47 up to 123. Add up to the nearest 100 (100), then in multiples of ten (up to 120) and then the last jump up to 123.
- This is in manageable steps.

They will also use informal jottings linked to partitioning which will have been touched upon in Year 2.

$$
\begin{aligned}
74 - 27 &= 74 - 20 - 7 \\
&= 54 - 7 \\
&= 46
\end{aligned}
$$

- Thinking about partitioning split up the 27 into 20 and 7
- Take away the 20, then take away the 7
- It is important not to try partitioning both numbers as this will cause confusion at this stage
- (4 – 7 = ?)

Once your child is secure on thinking about these methods they will be introduced to decomposition – a method which will be reinforced in Year 4 and is a good step to the more compact method.

$$
\begin{array}{lcccccccc}
 & & & \text{H} & & \text{T} & & \text{U} \\
148 - 27 = & & & 100 & + & 40 & + & 8 \\
 & - & & & & 20 & + & 7 \\
\hline
 & & & & & & & \\
\hline
\end{array}
$$

- Step 1 – partition each number and rewrite it vertically, making sure that the hundreds are underneath each other, the tens are underneath each other and also the units

$$
\begin{array}{lcccccccc}
 & & & \text{H} & & \text{T} & & \text{U} \\
148 - 27 = & & & 100 & + & 40 & + & 8 \\
 & - & & & & 20 & + & 7 \\
\hline
 & & & 100 & + & 20 & + & 1 \\
\hline
\end{array}
$$

This is the important sign to remember – we are doing a subtraction

- Step 2 – look vertically and take away the bottom number from the top number, starting with the units. (8 – 7 = 1)

(40 – 20 = 20)

(100 – 0 = 100)

		H		T		U	
148 - 27 =		100	+	40	+	8	
	-			20	+	7	
		100	+	20	+	1	= 121

Step 3 – recombine the answer

NB In Year 3 it will not be normal for your child to come across a question like above where the bottom number is larger than the top number (e.g. 30 - 40) – this is done in Year 4

Year 4

During Year 4 your child will continue to use the number line where necessary but the decomposition method started in Year 3 is consolidated.

		H		T		U
263 - 132 =		200	+	60	+	3
	-	100	+	30	+	2

- Step 1 – partition each number and rewrite it vertically, making sure that the hundreds are underneath each other, the tens are underneath each other and also the units

		H		T		U
263 - 132 =		200	+	60	+	3
	-	100	+	30	+	2
		100	+	30	+	1

- Step 2 – look vertically and take away the bottom number from the top number, starting with the units. (3 - 2 = 1)
(60 – 30 = 30)
(200 – 100 = 100)

This is the important sign to remember – we are doing a subtraction

$$
\begin{array}{rrrrrrrrr}
 & & & H & & T & & U & \\
263 - 132 = & & & 200 & + & 60 & + & 3 & \\
 & & - & 100 & + & 30 & + & 2 & \\
\hline
 & & & 100 & + & 30 & + & 1 & = 131 \\
\hline
\end{array}
$$

Step 3 – recombine the answer

Your child will also use this method to work out more complex questions which will involve the traditional idea of ‘borrowing’.

$$
\begin{array}{rrrrrrrr}
 & & & H & & T & & U \\
237 - 128 = & & & 200 & + & 30 & + & 7 \\
 & & - & 100 & + & 20 & + & 8 \\
\hline
 & & & & & & & \\
\hline
\end{array}
$$

- Step 1 – partition each number and rewrite it vertically, making sure that the hundreds are underneath each other, the tens are underneath each other and also the units

$$
\begin{array}{rrrrrrrr}
 & & & H & & T & & U \\
 & & & & & 20 & & \\
237 - 128 = & & & 200 & + & \cancel{30} & + & 17 \\
 & & - & 100 & + & 20 & + & 8 \\
\hline
 & & & & & & & \\
\hline
\end{array}
$$

- Step 2 – realising that 7 – 8 is not possible (without going into negative numbers) rewrite the question. Borrow 10 out of the tens column and put it into the units column.

$$
\begin{array}{lcccccc}
 & \text{H} & & \text{T} & & \text{U} \\
 & & & 20 & & \\
237 - 128 = & 200 & + & \cancel{30} & + & 17 \\
- & 100 & + & 20 & + & 8 \\
\hline
 & 100 & + & 0 & + & 9 \\
\hline
\end{array}
$$

- Step 3 – work vertically to answer units column (17 – 8), tens column (20 – 20) and hundreds column (200 – 100)

$$
\begin{array}{lccccccc}
 & \text{H} & & \text{T} & & \text{U} & \\
 & & & 20 & & & \\
237 - 128 = & 200 & + & \cancel{30} & + & 17 & \\
- & 100 & + & 20 & + & 8 & \\
\hline
 & 100 & + & 0 & + & 9 & = 109 \\
\hline
\end{array}
$$

- Step 4 recombine to work out the answer

This method of decomposition leads on to the more compact method which you may be more familiar with. This method is introduced in Year 4.

Example 1

$$
\begin{array}{cccc}
 & 2 & 6 & 3 \\
- & 1 & 3 & 2 \\
\hline
 & 1 & 3 & 1 \\
\hline
\end{array}
$$

- Step 1 – take away the units (3 – 2)
- Step 2 – take away the tens (60 – 3)
- Step 3 - take away the hundreds (200 – 100)

Example 2

$$
\begin{array}{cccc}
 & & 2 & 1 \\
 & 2 & \cancel{3} & 7 \\
- & 1 & 2 & 8 \\
\hline
 & & & \\
\hline
\end{array}
$$

- Step 1 – try 7 – 8 which is not possible without going into negative numbers
- Step 2 – borrow 10 from the tens column. This leaves 20 in the tens column.
- Step 3 – move the ten into the units column to make 17

$$
\begin{array}{cccc}
 & 2 & 1 & \\
 & 2 & \cancel{3} & 7 \\
- & 1 & 2 & 8 \\
\hline
 & 1 & 0 & 9 \\
\hline
\end{array}
$$

- Step 4 – take away the units
- Step 5 – take away the tens
- Step 6 – take away the hundreds

As with addition it is important that your child lays these questions out correctly using the squares in the books with a neat vertical layout in order to avoid mistakes.

Year 5 & 6

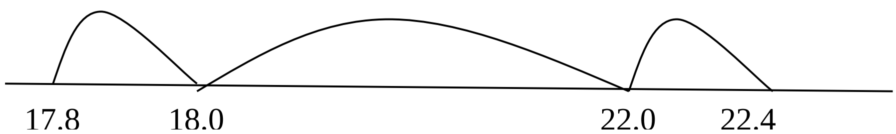
The number line will be used where appropriate in Year 5 and 6 and the more compact method of subtraction consolidated, including larger numbers and decimals.

$$
\begin{array}{ccccc}
 & & 1 & 1 & \\
 & 1 & 2 & 3 & 1 \\
 & \cancel{2} & \cancel{3} & \cancel{4} & 6 \\
- & 1 & 4 & 5 & 8 \\
\hline
 & & 8 & 8 & 8 \\
\hline
\end{array}
$$

EXAMPLES OF SUBTRACTION USING NUMBER LINES

Decimals

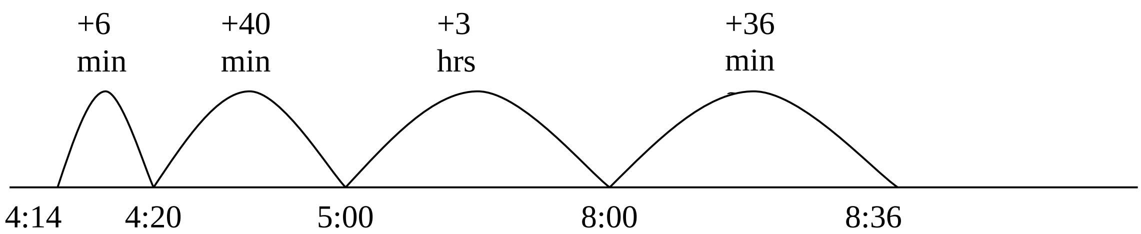
22.4 – 17.8 = 4.6



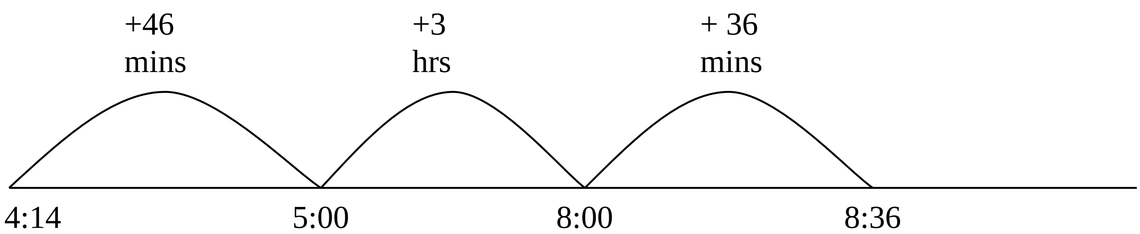
- Draw a blank number line and place 17.8 and 22.4 in the correct place
- As with finding the difference count up from 17.8 to 22.4
- Count up to the nearest whole number
- Count up in whole numbers to the nearest whole number
- Count the last small jump

Time

e.g. How long between 4:14 and 8:36?



- Draw the number line and put in 4: 14 and 8:36
- Count up from 4:14 up to the nearest ten minute (20min)
- Count up to the nearest hour (40mins)
- Count in whole hours up to the hour before you need to stop (3hrs)
- Count up to 8: 36 (36mins)
- Total up the mins and hours



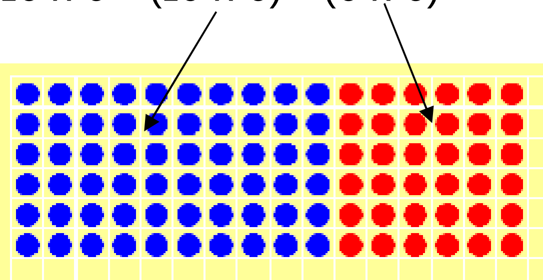
- Draw the number line and put in 4: 14 and 8:36
- Count up from 4:14 up to the nearest hour (46mins)
- Count in whole hours up to the hour before you need to stop (3hrs)
- Count up to 8: 36 (36mins)
- Total up the mins and hours

MULTIPLICATION

Year 3

During Year 3 your child will continue to become familiar with mental methods of partitioning. Arrays will be used to help visualise multiplication by partitioning:-

16 x 6 = (10 x 6) + (6 x 6)



Thinking visually about partitioning numbers helps to introduce the grid method of multiplication which your child will continue to look at through the rest of Key Stage 2.

16 x 6 = 96

X	10	6
6		

X	10	6
6	60	36

X	10	6	
6	60	36	96

- Step 1 – partition 16 into tens and units and re-write the question
- Step 2 - looking at columns and rows multiply 10 x 6 and then 6 x 6 and fill in the boxes
- Step 3 – Re-combine the min-multiplication steps you have done (60 + 36) = 96

There is a strong emphasis on learning multiplication facts for 2x, 3x, 4x, 5x, 6x, 10x in Year 3. We would ask that you help your child as much as possible with learning these as they are vital to the success of larger number multiplication.

Year 4

During Year 4 the emphasis on learning all tables will continue and the grid method of multiplication will be extended to larger numbers.

36 x 6 = 96

X	30	6
6		

X	30	6
6	180	36

X	30	6	
6	180	36	216

- Step 1 – partition 36 into tens and units and re-write the question
- Step 2 - looking at columns and rows multiply 30 x 6 and then 6 x 6 and fill in the boxes
- Step 3 – Re-combine the min-multiplication steps you have done (180 + 36) = 216

56 x 27 = 1512

X	50	6
20		
7		

X	50	6
20	1000	120
7	350	42

X	50	6	
20	1000	120	1120
7	350	42	392
			1512

- Step 1 – partition 56 into tens and units and 27 into tens and units and re-write the question
- Step 2 - looking at columns and rows multiply 50 x 20, 6 x 20, 50 x 7, 6 x 7 and fill in the boxes
- Step 3 – Look along the rows and add up the two numbers (1000 + 120, 350 + 42) Then do a column addition to add the final two numbers together (1120 + 392)

Year 5

During Year 5 your child will continue to use the grid method as Year 4, but this will also include multiplying decimals using the same method.

23.5 x 12

X	20	3	0.5	
10	200	30	5	235
2	40	6	1	47
				282

- Step 1 – split up 23.5 into tens, units, tenths, and 12 into tens and units and rewrite in a grid form
- Fill in the boxes by multiplying row x column
- Look vertically along the row and add up the filled in numbers
- Using column addition add up the final numbers

During Year 5 your child will also be introduced to a vertical layout of multiplication. This is purely an alternative way to the grid method, it is not necessarily better. During Year 5 and 6 we work to the aim of your child being confident in the grid method and it is one that secondary schools are used to children using as they move into Key Stage 3.

X	20	7	
6	120	42	162

	2	7	
		6	X
1	2	0	(20 X 6)
	4	2	(7 X 6)
1	6	2	

- Step 1 – Re-write the question vertically making sure that the tens and units line up
- Step 2 – thinking about the partitioning multiply the tens by the units and the units by the units. Make sure that the answers are laid out in the correct place
- Add up the answer

Year 6

During Year 6 your child will continue to use the grid method but may also use the vertical layout as shown in Year 5. This method can be expanded into larger numbers, but your child needs to be confident in their tables and mental arithmetic to be secure on this method. As explained, the grid method is the method we concentrate on here at Cheddington.

	2	7		
		6	X	
1	2	0		(20 X 6)
	4	2		(7 X 6)
1	6	2		

		5	6	
		2	7	X
1	0	0	0	(50 x 20)
	1	2	0	(6 x 20)
	3	5	0	(50 x 7)
		4	2	(6 x 7)
1	5	1	2	

A more compact vertical method may be shown if the teacher feels this is relevant.

	2	7	
		6	X
1	6	2	
	4		

		5	6	
		2	7	X
1	1	2	0	(56 x 20)
	3	9	2	(56 x 7)
1	5	1	2	
1				

DIVISION

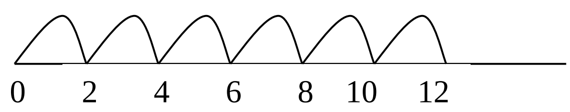
Year 3

During Year 3 your child will continue to use practical and informal written methods to divide two digit numbers. They will come across questions such as *'30 children are organised in teams of 6. How many teams are there? 30 pencils are shared equally into 6 pots. How many pencils are there in each pot?*

For calculations that children cannot recall mentally, they will use a number line to solve it. This method will be used throughout Key Stage 2 and as with grid multiplication, although other methods will be introduced in Year 5 & 6, they are not necessarily better than the number line. Some children prefer one method over another.

The advantage of introducing a number line is that through Key Stage 1 your child will have become used to thinking of division as grouping. They may well have used practical and visual resources such as bead strings to split a number into groups. This number line method directly links to this visual picture that your child will already have formed.

$12 \div 2 = 6$



- Draw a blank number line at place 0 at the beginning.
- Count in groups of 2 up to 12.
- Count the number of groups (arcs drawn)

The above method was introduced in Year 2 and will be reinforced in Year 3. Once confident in making single jumps, your child will be encouraged to think about larger jumps as shown in the example below.

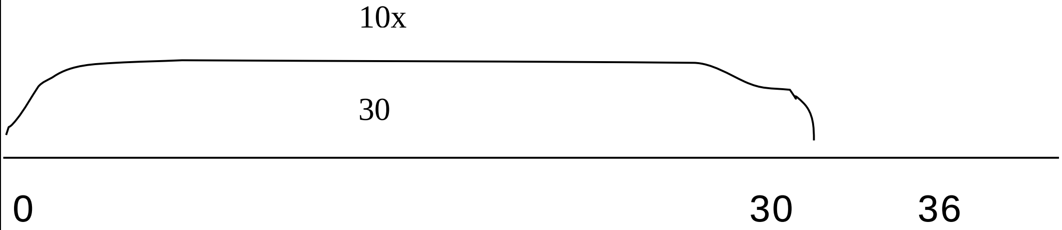
10x
5x
2x
1x

36 ÷ 3 =

0 36

- Step 1 – Draw a blank number line and put 0 at the left hand side and the number you are dividing on the right hand side (36 in the example above)
- Step 2 – write 10x, 5x, 2x, 1x, at the top right hand side to help prompt workings out.

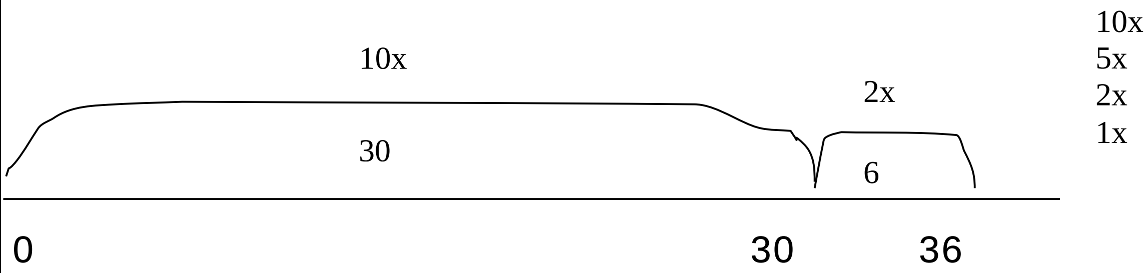
10x
5x
2x
1x



- Step 3 – think about the number your are dividing by (3) and thinking in groups of three look at the list at the right hand side and decide whether you can have 10 groups of 3 without going past your target number. The answer to this is yes, so draw and arc and write 10x above the arc.
- Think what 10 groups of 3 are (30) and write this underneath the arc.
- Then starting at 0 add on the thirty and place this number as shown

NB the way we will explain this in class is to say something along the lines of the following:

"I have 36 marbles in my hand and want to divide them amongst 3 children. I cannot work out straight away how many to give them so I need to think in numbers that I can work out easily. Can I give each child 10 marbles each and still have some left in my hand? Yes"



- Step 4 – thinking again about the list on the right hand side say can I have another 10 groups of 3 (answer no as this would be beyond the target number).
- Move to the number below and decide whether you can have 5 groups of three – (again the answer is no)
- Move to the number below and decide whether you can have 2 groups of three – (answer yes)
- Draw an arc and write 2x (two groups) above the arc, with (6) underneath the arc (answer to 2x3)
- Looking at the number line start at thirty and count on 6 to end at 36.

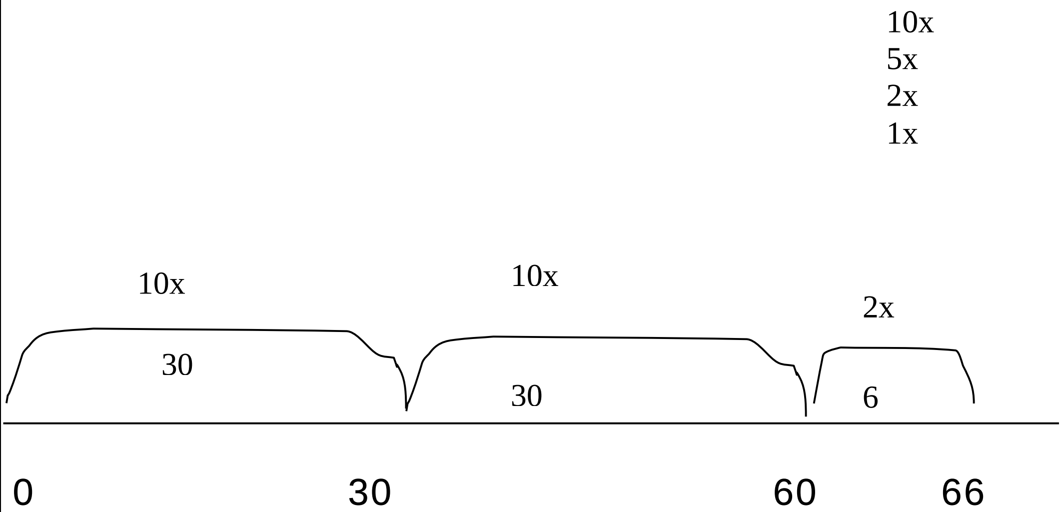
NB: In class the explanation may continue like this: *"Look at the top of the list – can I give each child another 10 marbles each? No, I don't have enough in my hand? Can I give each child 5 marbles each? No. Can I give them 2 each? Yes.......*(Once drawn).... *Now how many marbles did I give each child to start with? 10. And how many the second time? 2. So how many marbles does each child have? Answer 10 + 2 = 12."*

Year 4

During Year 4 your child will continue to use the above method for division, extending in to larger numbers and once confident, will make more efficient jumps as shown in example 2 below.

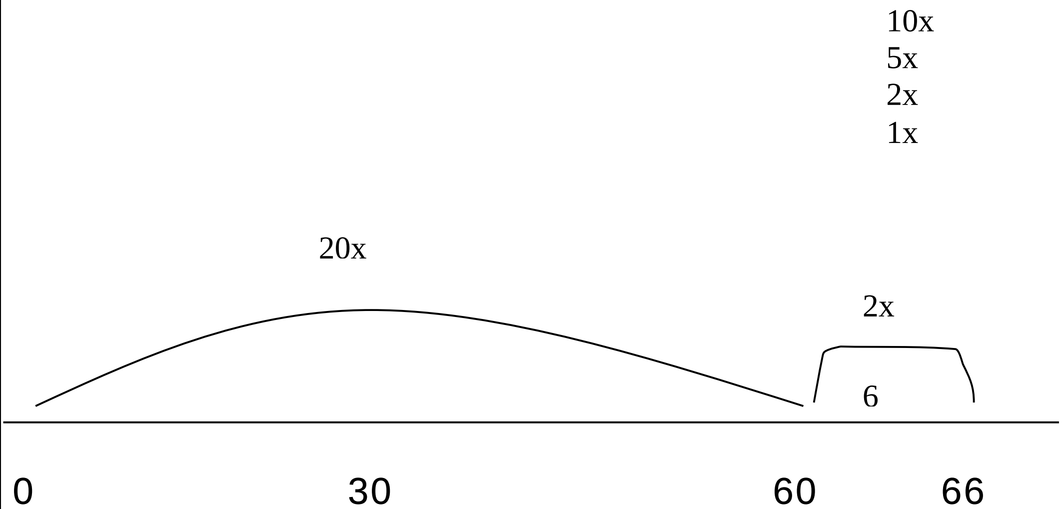
Example 1

66 ÷ 3 = 20 + 2 = 12



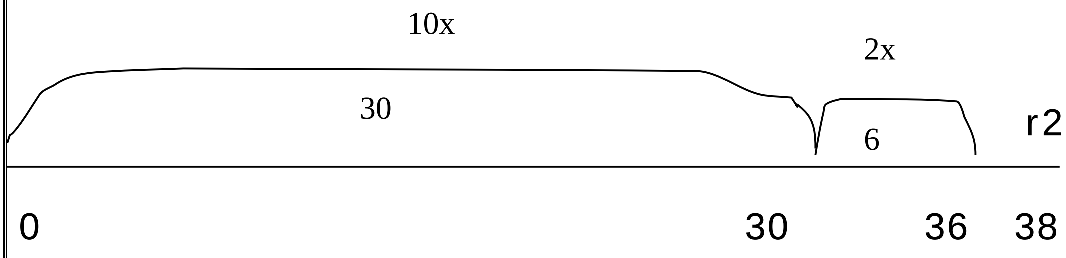
Example 2

66 ÷ 3 = 20 + 2 = 12



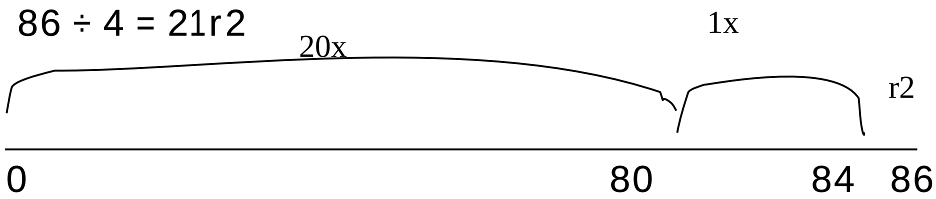
Remainders can also be worked out using this method

38 ÷ 3 = 12 r 2



or

86 ÷ 4 = 21r2



Year 5

During Year 5 your child will consolidate the number line method used in Year 3 and 4 and may be introduced to a more vertical layout called chunking. Again, this method is not necessarily better than the number line, but is an alternative. There are many ways in which mistakes can be made if the method is not understood fully, so we do continue with the number line method as it is an efficient way of carrying out division.

Chunking method

This method directly links to the number line method with the idea of grouping so if your child is confident in the number line method they may grasp this quickly.

$36 \div 2 =$

$$\begin{array}{r|rr} \cline{2-3} 2 & 3 & 6 \end{array}$$

- Step 1 – rewrite the question vertically

$$\begin{array}{r|rrl} \cline{2-3} 2 & 3 & 6 & \\ - & 2 & 0 & \text{(10 groups of 2)} \\ \cline{2-3} & 1 & 6 & \end{array}$$

- Step 2 – thinking about grouping decide if you can have 10 groups of 2 without going past the target number. Write 10 groups of 2 on the right hand side and the answer to 10x2 underneath the 36.
- Subtract 20 from 36 to find out how many you still have left to divide

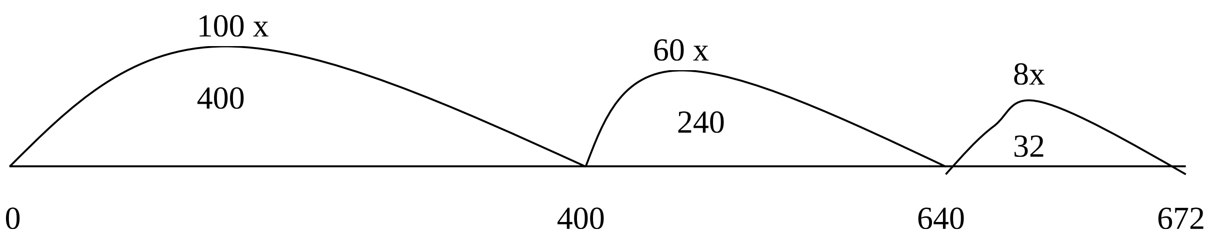
$$\begin{array}{r|rrl} \cline{2-3} 2 & 3 & 6 & \\ - & 2 & 0 & \text{(10 groups of 2)} \\ \cline{2-3} & 1 & 6 & \\ - & 1 & 0 & \text{(5 groups of 2)} \\ \cline{2-3} & & 6 & \\ - & & 6 & \text{(3 groups of 2)} \\ \cline{2-3} & & 0 & \\ \cline{3-3} \end{array}$$

- Step 3 – Thinking about grouping again decide that you can have 5 groups of 2 without going over the target number. Write 5 groups of 2 on the right hand side and the answer to 5 x 2 underneath the 16. Work out how many you have left to divide.
- Continue in this manner until you have divided / shared out everything

Year 6

Your child will primarily continue to use the number line method but with larger numbers and more efficient jumps.

e.g. 672 ÷ 4 = 168



They will also possibly use chunking as Year 5. This method of chunking can be used more efficiently once your child is used to working with multiples of 10

86 ÷ 3 = 28r 2

3	8	6	
-	6	0	(20 x 3)
	2	6	
-	2	4	(8 x 3)
		2	

Other more traditional methods such as the ones below are at the discretion of the teacher to use if they feel that these are appropriate for your child.

e.g.

672 ÷ 4 =

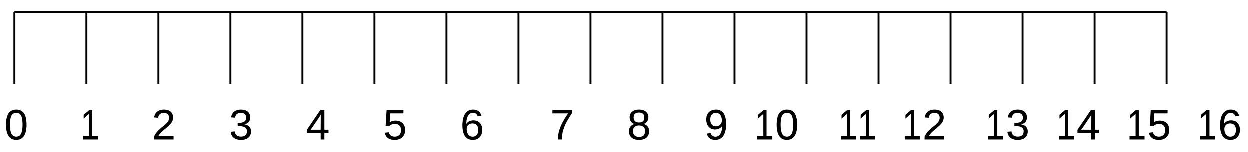
$$
\begin{array}{r|rrr}
 & 1 & 6 & 8 \\ \cline{2-4}
4 & 6 & 7 & 2 \\
- & 4 & 0 & 0 \\ \cline{2-4}
 & 2 & 7 & 2 \\
- & 2 & 4 & 0 \\ \cline{2-4}
 & & 3 & 3
\end{array}
$$

RESOURCES

Hundred Square

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

Number Line



Multiplication Square

x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

This booklet aims to explain how we, at Cheddington Combined School, teach your child different methods of calculation as they progress throughout Key Stage Two

Produced by R Ellis
Cheddington Combined School
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